ELECTRICAL REVIEW

[ILLUSTRATED]

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Ocean Telegraphy.

The mirror galvanometer (I may add for the benefit of those who have never seen one) is a circular coil of wire wound round a hollow tube, into which another tube can slide tightly. To a small circular mirror, of smaller diameter than the inner tube, is fastened, by a small quantity of wax, a minute steel permanent magnet, in length not exceeding the diameter of the mirror; a fiber of silk (from the cocoon) is fixed also by wax across the back of the mirror, and between it and the small magnet, in such a position that the mirror and magnet shall, by weight, be equally divided on each side of the fiber. Having balanced this accurately, the mirror is fixed by its top and bottom fibers across the tube in such a position that the mirror shall not only be central in the tube, but, when the tube is placed inside the coil, the center of the magnet and mirror may occupy the center of the coil. The galvanometer is then ready for use. An external permanent magnet is used for adjusting the zero position of the mirror, and for quickening its return to zero after being deflected. Various devices have from time to time been resorted to to sharpen the deflections of the mirror, the object being not so much a large deflection, as a sharp, short and clear one, with a rapid return to zero. Mirrors have been arranged to dip in a drop of oil at their lower edges. Others have been suspended in tubes filled with water and closed at the ends. Controlling permanent magnets have been inserted inside the mirror tubes, all of which have had the same object in view. It was very soon discovered that long suspension fibers would not do for rapid signaling, and that the shorter they could be made, consistent with the flexibility of the fiber, the better.

This was the only instrument used for ocean cables from 1866, until Professor Sir William Thomson invented his siphon recorder for cable work. This instrument is a most ingenious contrivance, and a marvel of accuracy in all its details. It is almost universally adopted by the large companies, and, therefore, needs here a minute description; and this I will endeavor to give to the best of my poor abilities in as simple language as possible, so that my young companion, whom I must not forget is still traveling along the road with me, may be able to understand its construction as well as its electrical action. In doing this, I fear I must trouble the editor to allow me to use an occasional diagram. It will be seen that hitherto I have avoided diagrams until we had arrived in the middle of our field of ocean telegraphy, otherwise I fear the space which would have been occupied by them would have postponed too much the attainment of our object. In viewing the construction of the recorder, my young friend will have to look back upon principles which have been already brought to his notice.

The diagram on this page (Fig. 2) represents the mirror, galvanometer and scale as used for testing purposes. If it be required to magnify the reflected ray, a lens of from six to nine inches focal length may be interposed between the lamp and the mirror. A vertical fine wire is sometimes fixed in the center of the slot, through which the ray of light passes from the lamp to the mirror, and the reflection of this will appear focused upon the scale in the center of the magnified spot, enabling the observer to read the division marked upon the scale with great accuracy.

In signaling, however, a plain piece of white card is preferable as a reading scale upon which the magnified ray falls, giving clearly-defined "spot" when the distances of lamp, mirror and scale are properly adjusted.

If the reader has to write for himself, a

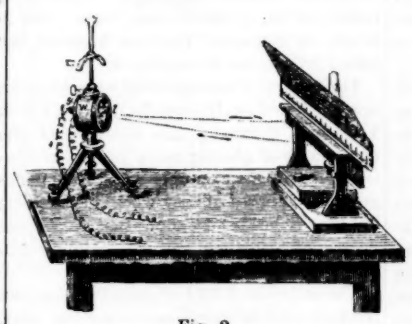


Fig. 2.

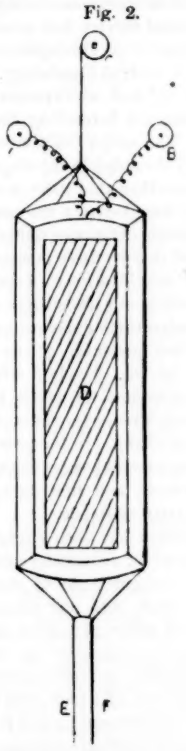


Fig. 3.

piece of looking glass can be fixed at the proper angle, so as to throw the reflected ray upon the writer's desk, and in this way he can read and write down very conveniently.

The siphon recorder of Sir Wm. Thomson was designed to record upon a paper "slip," or ribbon, the signals received through long cables which had usually been read aloud from the mirror galvanometer by one clerk and written down by another. To obtain a record of these signals, which, owing to the very low battery power used, are very feeble, a complicated, yet very beautiful arrangement of apparatus was designed for the receiving instrument, the remaining portion of the apparatus being the same as for mirror working.

It consists of (1) a suspended coil, (2) a powerful electro-magnetic field, (3) an ink reservoir, into which dips one end of (4) a very fine glass siphon, (5) a system of multiplying levers and fibers, and (6) an electro-magnetic mill, furnished with a cord and pulleys for giving motion to the paper slip, and for electrifying the ink in the reservoir. Each of these we will consider separately.

1. *The Suspended Coil.*—This is formed of

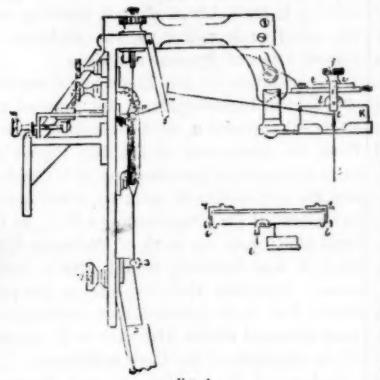


Fig. 4.

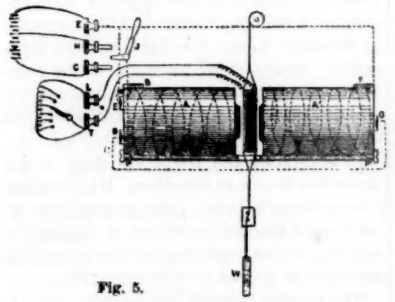


Fig. 5.

Fig. 6.

and continued as one thread to an adjustable screw, *r*, in Fig. 4, by which it can be raised or lowered as required; or it may be moved in any position horizontally, within the necessary limits, and clamped by another screw, *w*, provided for that purpose, when it is symmetrically arranged around, but not touching the soft iron centerpiece, *D*. At the bottom of the coil similar threads are fastened to the four corners, but these terminate a short distance from each other, and, being there tied, are continued as two threads downwards, *E*, *F*, to each of which is fixed a small leaden weight to keep them taut. Between the coil and the weights the threads rest against a small bridge, *x*, upon which the distance between them can be regulated. This bridge is also adjustable upwards or downwards, so as to diminish or increase the distance between it and the suspended coil; it is secured in the desired position by means of the clamping screw, *y*; its object is to impart controlling power to bring the coil back to its zero position after being deflected. Weights of different sizes are supplied with the instrument, so that they can be increased or diminished if found necessary. The suspended coil and its attachments are fixed to a movable frame, Fig. 4, which can be re-

Fig. 7

Fig. 8.

moved from the instrument by loosening the clamping screw at the back of the bed-plate. An ebonite arm carries the suspended coil and its attachments at one end, and the ink reservoir and siphon frame at the other, insulating them from each other.

2. A powerful magnetic field is provided by means of two large electro-magnetic coils, Fig 5, wound with thick covered wire round massive soft iron cores. They are arranged horizontally, the poles facing each other and opposite each side of the suspended coil. The other ends of the cores are joined together by a heavy, semi-circular soft iron bed-plate, upon which the soft iron flanges of the coils rest at their outer ends; the inner ends having brass flanges, and only the central cores protruding opposite the suspended coil. The two coils thus connected form a very powerful electro-magnet when a current from a large battery of very low internal resistance is sent through the wire. This magnetic field is still further enhanced by the presence of the soft iron armature *D* within the walls of the coil of fine wire. The large coils can be joined up either in series or in multiple arc by means of the connecting levers supplied for that purpose and attached to the instrument.

The current for these coils is obtained from large, flat tray batteries made of wood and

lined with lead, carefully varnished, except at the center, where contact is made with a copper sheet when placed on the bottom of the tray inside. The lead lining is continued over the four corners to the outside and underneath them, forming four metallic contacts, which must be scraped quite clean where they meet the four projecting corners of the zinc grating beneath them. The zincs are usually covered with parchment paper and placed on four earthenware cubes, and are thus supported over the copper sheet, which rests on the bottom of the tray.

The battery is built up thus: Upon an insulated stand place the bottom tray, having made a soldered connection between the leaden lining and a piece of stout copper wire, *c*; place a sheet of copper in the tray, and at each corner an earthenware block; on the blocks rest a zinc grating, with the four projecting corners upwards; upon these place the second tray, and repeat the process till as many are built up as are required, making another soldered connection to the final zinc *z* for attaching the leading wire to the instrument.

To charge the trays, mix two pounds of sulphate of zinc with one gallon of water, pour it into the trays, filling them up to the level of the tops of the zinc gratings. Next crush some crystals of sulphate of copper small, and distribute about an ounce along each of the four sides of each of the trays on the copper plate, taking care not to put any on the earthenware blocks. The battery will then be ready for use. When required to work twenty-four hours a day, it will be necessary to feed each tray with four ounces of sulphate of copper daily for the electro-magnetic coils, and about half that quantity for the mill battery. The liquid in the trays will require to be drawn off occasionally and replaced by fresh water.

3. The ink reservoir *K* (Fig. 4) is supported upon a small shelf with raised sides, into which it fits easily, fixed to one end of the frame. The ink is made by dissolving aniline blue in water.

4. A fine glass siphon, of the shape shown in Fig. 8, is fixed to a frame over the ink reservoir. The frame is shown in Fig. 7. It can be adjusted forwards or backwards, and clamped in position by the screw *j*, in Fig. 4. It has a curved spring at each end, between which a platinum wire, *l l* (Fig. 7), is stretched, and upon which an aluminium "cradle," *s*, is threaded; to this ⌐ shaped piece the glass siphon *t* is attached by a small quantity of wax. The upper bent end (Fig. 8) dips in the ink tank *K*, while the lower end of it is presented opposite to the paper upon which the signals are to be recorded, but *not* in contact with it. The paper used is five-eighths of an inch in width.—*The Telegraphist.*

Recent Advances in Electrical Science.

By John Trowbridge.

Electrical science has not made great strides during the year 1884; but in the direction of practical applications it is feeling the powerful aid of business ability and capital. The U. S. Patent Office is crowded with applications for patents on various electrical appliances. The scientific investigator must soon make a struggle for the free use of many old and familiar electrical appliances which he has known from boyhood, unless he, too, enters the field as an applicant for patents. The tendency of the times is certainly in the direction of obtaining patents in order to prove priority, even in the direction of pure science. We leave it to the moralist to decide the difference between a copyright for a literary man and a patent for a scientific man.

The problem of electric lighting is gradually yielding to the efforts of the great army of inventors. The Edison Company has plants in almost all countries. The incandescent system has made its way on steamboats and steamships. The great Fall-River line of steamboats took the initiative in lighting the steamer Pilgrim, and has now extended the system to the other principal boats of the line. It is said that, although the cost of lighting by incandescence is double that of gas, the better quality of light and the greater safety from fire counterbalance the increased cost. Experiments have been made by the Weston Electric Light Company during the year, upon long-filament incandescent lamps, which promise to give lamps approaching the candle-power of many arc-lights with a far pleasanter and steadier light.

Among the methods of electric lighting by incandescence, which have received renewed advocacy during the year, is the battery system. Trouvé's modification of the bichromate-of-potash battery consists in employing a very large proportion of sulphuric acid with bichromate of potash. An experience of three months with this battery will lead its most enthusiastic advocate to long for a cheaper source of electricity.

The problem of electric lighting is to find a cheaper motor than the steam engine to drive the dynamo-electric engine, or to discover a more direct process of obtaining electricity from heat. No advance has been made this year in the generation of electricity by thermo-electricity. The meetings of the British Association at Montreal, and the American Association in Philadelphia, did not result in the production of many important papers on electricity; yet there is no doubt that many persons had their ideas clarified and their thoughts stimulated by these meetings. Perhaps the coming year will bear evidence of this. The electrical exposition in Philadelphia showed the great activity in the fields of electric lighting, and was chiefly interesting as an exhibition of various types of dynamo-machines.

The members of the Electrical Congress, also held in Philadelphia at the time of the electrical exposition, were inclined to dissent from the resolutions of the late Paris Congress in regard to the adoption of a hundred and six centimeters of mercury, a millimeter in section, at the temperature of 0° C., as the legal ohm; since the work of Professor Rowland, it was believed, would give a closer value. Professor Rowland has not yet published, but it is believed that results have been obtained which will lead to a revision of the decision of the Paris conference. The members of the conference also dissented from the conclusions of the Paris conference upon the adoption of the platinum standard of light; and a committee of the U. S electrical conference is now engaged upon the study of a suitable standard. The suggestion by Siemens to use the light emitted by a square centimeter of platinum at the point of fusion, under the action of a known current of electricity, seems a fruitful one; and the committee is testing its capabilities.

In telegraphy and telephony there is not much that is new to chronicle. It is, perhaps, a blow to our national pride to learn that we are behind England in the art of telegraphy, and that we are importing certain telegraphic instruments instead of exporting them.

The London central telegraphic office is certainly not approached in this country for completeness and system. There is a certain analogy between the action of the Irish settler in New England who burns up the fences and cuts down all the wood, and, in short, *skins* the farm, and the action of telegraphic and railroad corporations which run a system, but do not add to it as long as subsistence and dividends can be obtained. The American visitor to the London central office however, can but be amused, that a separate room, with instruction, is provided for those operators who are to learn the reading of messages by sound. In America it was the operators who taught the superintendents that this method of receiving messages was preferable to the Morse register system.

We learn that the Bell Telephone Company has lately completed a special line between Boston and New York, and proposes to open telephonic communication between these cities. With the new powerful transmitters that have been and undoubtedly are to be invented, a great increase in the range of telephony is to be expected. Already most of the towns and principal cities throughout New England are connected by telephone lines, to the great detriment of livery stables and of stage lines. The study of this new method of village communication we leave to the political economist. The system is destined to work great changes in manners and customs.

Unfortunately, the storage of electricity, so-called, does not fulfill the extravagant hopes that were excited when Faure's battery burst upon the world. It is now found that the Plante battery is more practical than the Faure, and that, under careful methods of forming, it gives better results than the Faure and its various modifications. None of the storage batteries now in use can be said to be commercial successes, for all of them deteriorate seriously in time. To the scientific investigator, however, they are extremely useful. One having a small electrical plant can charge his secondary batteries at his leisure, and thus have on *tap* a steady source of electricity. To the investigator who has ruined many suits of clothes with acid batteries, and whose hands have almost ceased to be the insignia of gentle birth, the storage battery is already a great boon.

Much has been said and written upon the subject of the transmission of power by electricity. It is proposed to try different systems upon a certain portion of the elevated railways of New York. Nothing but an experiment upon a sufficiently large scale, under intelligent scientific supervision, can determine whether the electrical transmission of power can compete successfully with the use of the locomotive on public exposed highways. There is a future for this system in many ways, even if it fails on railways. The year, however, has added little to our knowledge of it.

The subject of underground wires has been much agitated lately, and the Western Union Telegraph Company has lately tried the experiment of placing many of its lines between two distant points in Boston under ground. At present they work successfully; but time is needed to show that a suitable degree of insulation can be maintained in this frost-afflicted climate.

The scientific theory of electricity has not received notable accessions during the year. The U. S. signal service has established stations for the study of atmospheric electricity at Baltimore and at Cambridge. It is believed that electrical observations will give additional data for foretelling the approach of storms. The subject of atmospheric electricity is still shrouded in mystery; and little more is known than that there is a difference of electrical level between the earth and the air, and that this difference undergoes modifications, and that we have methods of measuring these modifications. Little progress has been made in our knowledge of the connection between earth-currents and changes in the electrical potential of the air. It is maintained by Mr. Blavier, who has had several experimental telegraph lines under his direction in France for the study of earth-currents, that changes in the potential of the air cause very small changes in the character of earth-currents, and that the latter have a real and separate existence.

Lord Rayleigh has been engaged upon a study of the silver voltameter and its application to the measurement of electrical currents. He finds that one ampere deposits four grams of silver per hour, and a sufficient amount can therefore be obtained for accurate weighing in fifteen minutes. Pure nitrate or chlorate of silver gives the best results. Beetz has proposed a new form of Daniell cell, of great internal resistance. Fine alabaster plaster-of-Paris is mixed with concentrated sulphate of copper solution, and the copper electrode is fixed in this at one end of a glass tube; the rest of the tube is filled with concentrated sulphate of zinc and plaster-of-Paris, and the zinc electrode is also embedded in this. The ends of the tube are filled with paraffine. This form of cell has been tried at the Jefferson physical laboratory of Harvard University, and has been found an excellent substitute for the water-cell of zinc and copper for charging electrometers.

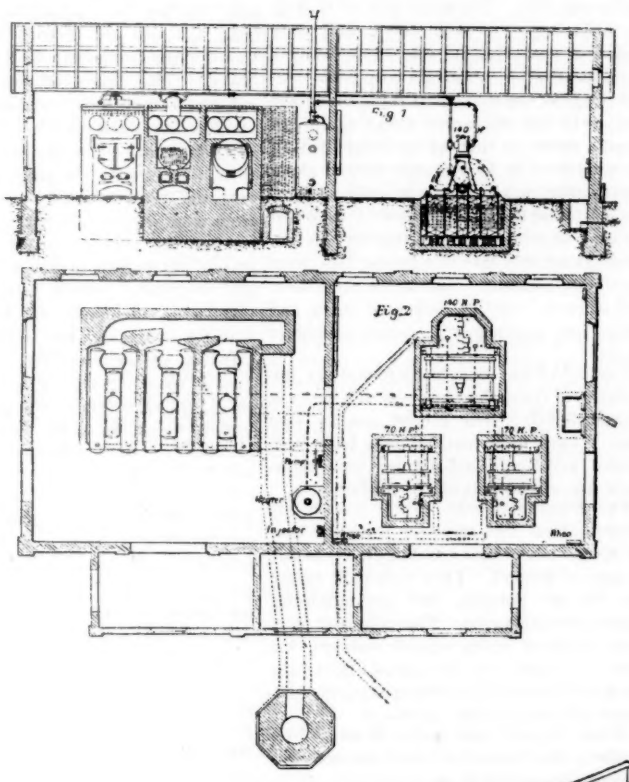
The lull in the progress of theoretical electricity is probably the precursor of important additions to our knowledge; for many investigators are at work, both at home and abroad, testing the new electrodynamic theory of light, and adding to our knowledge of magnetism. The equipment of physical laboratories in America, which has been one of the features of the year at Cambridge as well as elsewhere in America, bids us hope for much systematic study of the science of electricity, and physical science in general.

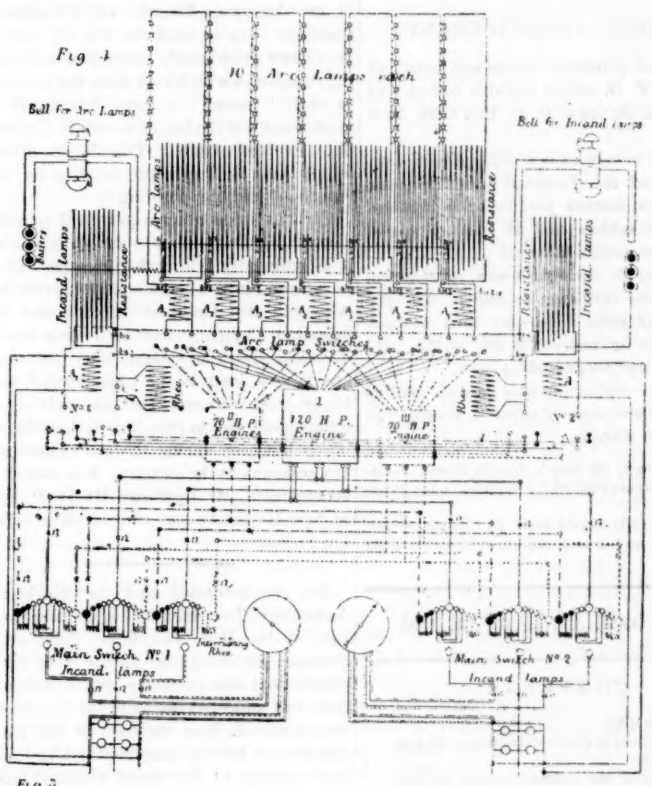
Electric Light at the Central Station at Buda-Pesth.

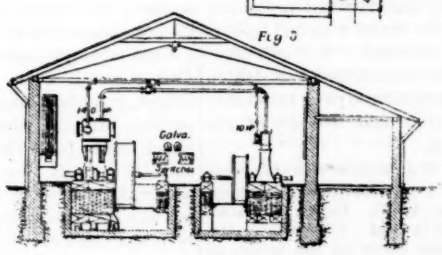
An electric light installation of some importance has been in regular work for some time past and has so far proved very successful: it is the installation of the new Central Railway Station at Buda-Pesth. It has been carried out by Messrs. Ganz & Co., of Buda-Pesth, and contains seventy arc lamps of 600 standard candle-power each, and 685 incandescent lamps, of which 250 are of 20 candle-power and 435 of 12 candle-power each. The arc lamps are distributed as follows: Two outside the building over the entrance, two on the arrival platform, and four in the sliding roofs. The departure platform, which has a roof nearly 100 feet high, is lighted by altogether fourteen arc lamps, of which four are in the roof and five on each side platform. The permanent way has independent illumination, consisting of twelve arc lamps mounted upon wrought-iron lattice posts 27 feet high; two more lamps are used for lighting the line on the starting side of the station, while ten are placed in the ticket offices and ten more in the refreshment rooms. The postal offices contain four lamps, the luggage offices five, the third-class waiting-room three, and the covered yard devoted to postal service contains the remaining two lamps. These arc lamps, which are all of the Zipernowsky system, are partly constructed for a single pair of carbons, capable of giving light for eight hours; partly they have double carbons with automatic switches so as to burn for sixteen hours. The wires are in all cases arranged in such a manner inside the lamp-posts that they are not visible from the outside. The seventy lamps are divided into seven series of ten lamps each, each lamp working with a current intensity of 14 amperes and 40 volts. The main wires are of copper and each 0.16 in. in diameter; any lamp can be cut out of the main circuit, the length of which varies from 750 to 1,200 yards, while their aggregate length is nearly 12,000 yards.

In the distribution of the incandescent lamps, the space to be lighted was carefully considered, and a lamp of 15 candle-power provided for every 880 cubic feet. Every lamp can be cut out of the circuit, as may also any series of lamps be cut out of the general system. The main cable consists of a polished copper rod 0.67 in. in diameter, insulated by cotton fabric soaked in shellac; this is placed in iron pipes cast in halves, spaced by wood bearings, and the whole filled up by molten asphalte. Each single lamp, as well as each series, is fitted with a fusible cut-out, and all the leads are made of such dimensions that they will admit of additional lamps to the extent of 15 per cent. Figs 1, 2 and 3 of our illustrations on page 3 show the arrangement of the boiler and engine of this installation. The building is 88 ft. long, 45 ft. wide, and 16 ft. high, and is divided by a central wall into two equal parts; one containing the three boilers, consisting each of a multitubular boiler provided with two cylindrical water boilers placed over it, and one steam collector; each boiler has 970 square feet of heating surface, and the three work into one main flue placed above the floor level; through this the smoke passes to the 82 ft. chimney, 4 ft. 3 in. in diameter. The boilers are all connected by one wrought-iron steam pipe, which passes into the adjoining engine-room, and is here divided into three branches, supplying steam of 140 lb. pressure to the three engines. A donkey pump, a Korting injector, and a feed-water heater, through which the exhaust steam passes previous to its escape into the outer air, complete the equipment of the boiler-house. The adjoining engine-room contains one engine, of which drawings and descriptions have already appeared

in our columns (see *Engineering*, vol. xxxvi., page 411), and which was exhibited at the Vienna Exhibition. This engine is of 140 horse-power, and was built, like the boilers, by the Prager Maschinenbau Actien Gesellschaft. The engine is, as will be remembered, of the compound type. It has cylinders of 11.4 in. and 17.3 in. in diameter, and 17.3 in. stroke; running at 150 revolutions, and with an initial pressure of 140 lbs., and a cut-off at about $\frac{3}{8}$; it is capable of exerting 140 horse-power. It is fitted with Meyer's expansion gear, adjustable while running. There are, in addition, two smaller engines with cylinders 9 in. in diameter, and $15\frac{3}{4}$ in. stroke, running at 240 revolutions, and with an initial pressure of 140 lbs., capable of exerting 70 horse-power each. These two engines were built by Messrs. Kagler and Roszner, engineers, of Buda-Pesth, and are fitted with the governor illustrated in *Engineering*, vol. xxxvii., page 57. All three engines are of the vertical type, and the dynamo machines which they drive







ELECTRIC LIGHTING OF THE CENTRAL RAILWAY STATION, BUDA-PESTH, HUNGARY.

are arranged in the flywheels, as shown in our perspective views, vol. xxxvii.. page 428. The armature of the large dynamo consists of thirty-six bobbins arranged on the circumference of the flywheel. One of the bobbins serves as exciter for the rest. They rotate inside a cast-iron ring fitted with the induction coils, and which can be easily shifted sideways so as to allow of adjustment or repairs.

The small dynamos have each 22 bobbins and 22 induction coils, similarly arranged as in the large machine. Ten induction coils in each machine are coupled in three circuits for the arc lamps, and are wound with 2.2 mm. wire, while the remaining twelve coils are coupled in parallel circuit for the incandescent light, and are wound with 4.2 mm. wire. The bobbins have wire of 2.8 mm. diameter. The advantages of this arrangement are, compactness, absence of straps, or any other gearing, high surface speed of the dynamos in the magnetic field with comparatively low speed of shafting, only three bearings, perfect accessibility of all parts of the dynamo, since by only one turn of the engine, the ring carrying the induction coils can be shifted sideways, and as a consequence less liability to break down.

This in all machinery is a matter of great importance, but one of vital consequence in an electric light installation for a railway station not fitted with gas. In this installation, the large engine and one of the small are, under ordinary circumstances, at work, while the second small engine is kept running slowly, so as to be ready at a moment's notice to take the place of either of the others, the large engine being, in case of necessity, capable of supplying sufficient light for some hours. After eleven o'clock at night part of the power is shut off, and one of the small engines alone supplies the required current.

This arrangement has necessitated the construction of a somewhat complicated switchboard, of which we give a diagram in Fig. 4, from which it will be seen that each machine supplies both arc and incandescent lights, and that either of these, or some, can be thrown out of circuit without interfering with the rest. An automatic rheostat regulates the current in each circuit within certain limits, but should all lamps in one circuit be turned out, a bell rings in the engine-room to enable the engineer to cut this line out entirely, another bell calls him to attention if the current strength is insufficient in consequence of exceptional demand on the engine. This switchboard, though somewhat complicated, has, like the whole installation, given every satisfaction.—*London Engineering.*

Voltaic Electricity.

SYNOPSIS OF THE INSTRUCTIVE LECTURE BY WILLIAM FINN, OF BUFFALO.

The Buffalo Electrical Society held their regular meeting last week, at their hall, 18 East Seneca street. Mr. William Finn of the Western Union office, lectured on the subject of "Voltaic Electricity." After briefly recapitulating some of the points touched at the previous meeting, the lecturer incidentally remarked that the zinc oxide which formed in a battery where water only was used could not be dissolved in water, and for this reason the zinc plate became isolated from further action on the part of the liquid. But while this proved to be a serious detriment in the case of a battery, it played a very important part in the preservation of those iron wires erected for telegraphic purposes, which were exposed to the action of the atmosphere, for by galvanizing the wires by immersing them in a bath of molten zinc they were effectually protected from "rust" as the union of the oxygen of the air with the zinc-coat and wire formed an oxide of zinc which was insoluble in water, and could not therefore be washed off by the rain. The lecturer then proceeded to explain in detail the chemical actions taking place in a "gravity" battery and how it was set up and maintained. The "gravity" battery was so called because of the difference in the densities of the two liquids employed. The solutions of copper and zinc sulphates was taken advantage of according to a well-known law to cause separation of the fluids by placing the lighter solution of zinc sulphate upon the denser

COPPER SULPHATE SOLUTION.

This obviated the necessity for the porous divisions, which were at one time introduced for keeping the different liquids apart, but which proved to be a constant source of trouble, besides adding to the resistance of the circuit. Polarization of the battery was prevented by surrounding the copper plate with a strong solution of copper sulphate, which absorbed the hydrogen gas that would otherwise be liberated at the surface of the copper-plate and reduce the action of the battery.

The quantity of electricity generated was proportional to the amount of zinc consumed in the battery, and as every 100 ounces of copper sulphate contained 25¼ per cent. of metal, that quantity of copper was precipitated on the negative (copper) plate for every equivalent, or 23 ounces of zinc dissolved. The chief merits of a battery, electrically speaking, consisted in its having a high electro-motive force, a low internal resistance, and remaining steady in its action.

The "gravity" battery perhaps fulfilled these conditions better than any other battery used in telegraphy. The constancy of the battery was maintained by surrounding the zinc plate with a semi-saturated solution of sulphate of zinc which, though not so good a conductor as the dilute sulphuric acid ordinarily employed, yet for that very reason diminished the "local action" which always takes place on the generating plate when the ordinary zinc of commerce is used, and which action is one of the principal sources of a

FLUCTUATING CURRENT.

One cell under certain conditions can be made to give as much current as a hundred or thousand cells joined in series, and thus it becomes an easy matter to ascertain the condition of a battery. All that is necessary is to connect a cell in perfect condition to the copper band of a Tangent galvanometer and observe the deflection of the needle. If, when a number of cells are connected in the same manner the deflection remains unaltered it will show them to be in good condition, but a lesser deflection would indicate a less satisfactory condition of one or more of the cells. This was clearly demonstrated by "Ohm's law," which states that the current obtained is dependent upon the electromotive force of the battery divided by its resistance. If the electro-motive force and resistance increased in the same proportion the current remains the same. This is what happens under the above mentioned conditions.

The electro-motive force of the series is increased in proportion to the number of cells added, but so also is the resistance and the current therefore remains the same.

Returning Prosperity.

Our contemporary, the Chicago *Journal of Commerce*, says: "If straws show which way the wind blows, there can be little doubt that the industrial zephyrs are blowing in the direction of greater and more permanent activity. This is to be gathered from the fact that a number of idle rolling mills and furnaces at Cleveland, Ohio, are about resuming business after a long period of idleness. The same is also true of several Pittsburgh establishments of a like nature. It is further announced that the proprietors of certain idle mills in the West, realizing that the demand for rails must necessarily be light for some time to come, are about changing their works into merchant iron mills in order to start up again. These indications of returning activity are not overwhelming, it is true, but as far as they go they are cheering. They indicate that surplus stocks are gradually worked off, and that, although prices rule extremely low, the demand for iron and steel is increasing. Small profits are better than no profits, and mills rust out and depreciate in value while idle. Low prices have one merit, at least—they help to stimulate consumption, and the fact that a few mills are starting up at present indicates that this law of trade is working out its legitimate result. The public will hope that the few resuming establishments may prove as the first faint streaks of dawn which are to usher in the full sunlight of returning prosperity."

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NEW YORK, JANUARY 31, 1885.

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In Newport, R. I., the City Council voted to do away with electric lights. Forthwith the citizens got together, expressed their disapproval in very strong terms, and made it so warm for the Councilmen that they got together again in hot haste and rescinded their vote. The trouble is that the public wants the electric light, and will have it.

All the evidences point to a very large attendance of delegates at the electric light convention in Chicago. Some think it is a matter of regret that our so-called "parent" company is doing what it can to prevent its offspring from being represented. These children, though young, not only have to look after themselves, but also do a good deal towards supporting their parent, which would seem to indicate that they have passed beyond childhood. It is not wholly improbable that the evident unwillingness of the parent that the children should attend will make the latter all the more anxious to go.

In his annual message last week, Mayor Low of Brooklyn says: "The underground telegraph law, so called, of last session has been a great embarassment to the city. Its only known effects thus far, excepting a slight experiment with underground wires by the telephone company in the neighborhood of the City Hall, have been to prevent the city from securing $5,000 worth of telephone service per annum free of cost, and to prevent, in a number of instances, the extension of the fire alarm telegraph system. The effect of the law is wholly negative. It does not provide a single positive direction or method as to the accomplishment of the end which it enjoins. I am clearly of the opinion that Brooklyn ought to be exempted from its provisions, unless at the ensuing session of the Legislature it can be made a practicable measure."

During the past week an important negotiation, which has been in progress for some weeks, has been brought to a satisfactory conclusion. Mr. Edward H Goff, president of the American Electric and Illuminating Company, has secured for himself, and for gentlemen prominently connected with lighting companies which look upon the American as their "parent," a large interest in the capital stock of the Boulton Carbon Company of Cleveland, Ohio. This is an alliance which has an important bearing on their future of electric lighting.

Carbons are as much a part and parcel of electric lighting as lamps and dynamos, and it is eminently fitting that electric lighting men should have a hand and an interest in it. Although the American Electric and Illuminating Company has used thus far the Thomson Houston system, it is free to use any system, and is the exponent of none. Its business is to construct and sell electric light plants, and in this line it has done as much business during the last 18 months as any company in the country. As a part of this arrangement, Mr. Goff and Mr. H. P. Frost, of New Haven, become directors in the Boulton Company.

We are informed that the Minister of Agriculture has delivered a decision in the case of the Bell Telephone Company of Canada, declaring the patent void for the reason that the company or its representatives had imported the patented articles after twelve months from the date of the patent; also for not having manufactured in Canada such articles to the extent required by law after two years of existence of their privilege, and also for having refused to sell or deliver licenses to persons willing to pay a reasonable price for the private and free use of the patented invention.

On September 2 a petition was addressed to the Hon. J. H. Pope, Minister of Agriculture, asking that A. G. Bell's telephone patent be declared invalid. Counsel for the appellant based his claim on the failure of the Bell Telephone Company to comply with section 28 of the patent Act of 1872, which provides as follows:

"That every patent granted under this act shall be subject, and expressed to be subject, to the condition that such patent, and all the rights and privileges thereby granted, shall cease and the patent shall be null and void at the end of two years from the date thereof, unless the patentee or his assignee or assignees shall within that period have commenced, and shall after such commencement carry on, in Canada, the construction or manufacture of the invention or discovery patented in such manner that any person desiring to use it may obtain it or cause it to be made for him at a reasonable price at some manufactory or establishment for making or constructing it in Canada, and such patent shall be void if after the expiration of twelve months from the granting thereof the patentee or his assignee or assignees for the whole or part of his interest in the patent imports or causes to be imported into Canada the invention for which the patent is granted, and provided always that in case disputes arise as to whether a patent has or has not become null and void under the provisions of this section, such disputes shall be settled by the Minister of Agriculture or his deputy, whose decision shall be final."

This decision will not make so very much difference with the company, as they are in possession of the field and doing about all the business there is to do, having a well-established plant in every town of importance in the Dominion.

The remedy for gas extortion proposed at the meeting on Tuesday evening seems to be of very little promise. A legislative investigation is asked for. Last year, which was in this respect exceptional, there might have been something to hope from such an investigation; this year there is nothing. The only alternative now at hand is to put in the electric light in every case possible.

The Boulton Carbon Works.

[Editorial Correspondence of the ELECTRICAL REVIEW.]

CLEVELAND, Jan. 27, 1885.

I had just settled down for my usual constitutional Sunday afternoon nap when your telegram came to hand, asking me to start at once for Cleveland. I got "under way" at once, and six o'clock found me on board the Boston and Albany train, westward bound. On Monday morning I breakfasted at Syracuse, where the meals are excellent and the waiters rather over-attentive. At noon we were at Buffalo for dinner, and soon after started out for this city. Ten miles west of Buffalo the train began to slow down, and soon came to a dead stop, the sole cause being a strong head wind, which actually made further progress impossible. Taking advantage of a partial lull, we forged ahead again, got round a curve so that we no longer looked the wind dead in the eye, and worked along comfortably, making this city only an hour late. I found the mercury down to zero and the wind blowing a gale, so that my first impressions of this fair city by the lake were not wholly pleasant. But at the hotel there was warmth, comfort and good cheer, and things very soon began to wear a pleasanter aspect.

I thought I had an appreciation of the importance of the carbon business as a factor in electric lighting, but I must confess that since I have been here my eyes have been opened, and I am enabled to see how inadequate my conceptions of the subject were

The Boulton Works, newly erected, ere situated about three miles out from the center of the city. The buildings cover nearly an acre of ground. They were built especially for the purpose, and are admirably planned and arranged. The company originally occupied much smaller quarters, but when it bought out the United States Electric Light Company's carbon-making business larger quarters became necessary.

When the arc light began to be used extensively, the basis of all carbons made was the coke remaining in gas retorts after all the gas and other products had been extracted. This material, while in many respects excellent, contained more or less mineral impurities, the same which constitute the ash which results from the combustion of coal, and the supply was limited. It finally occurred to somebody that the coke which is left as a residuum from the final distillation of petroleum was free from any objection on the score of mineral impurities, and the supply was sufficient for all probable demand. At that time this petroleum coke was a waste product of the distilleries, and it was actually a matter of expense to them to get rid of it. Examination and analysis showed that this petroleum coke was over ninety-nine per cent. pure carbon, and experiments made with it showed that the resulting "points" were superior to anything previously produced.

There has always been a great deal of reluctance on the part of manufacturers of carbon "points" to impart to any one any of the details of their processes, but in Mr. Bolton I found a man who took broad views on the subject, and was not averse to having the story told as a matter of public interest, reserving, of course, certain secrets of the trade which have been learned as the result of much costly experiment and experience.

Let me say that the object which every manufacturer of carbon "points" has constantly before him, is to produce an article which shall possess a maximum of electrical conductivity, and a minimum of combustibility, that is, a carbon which will offer the least resistance to the passage of the electric current and last the longest. Added to this is the absolute requirement that the carbon, when finished, be exactly straight. This is a requirement not a little difficult to fulfill, because the baking process tends to warp and twist the "points," and presents a difficulty which it is by no means easy to overcome.

The petroleum coke, of which the Bolton Company grinds up and consumes about twenty-five tons every week, comes in lumps which look like charred sponges. It is very porous, very light, and thicker than the ordinary coke carbon, such as is used in the manufacture of iron. The first process is to grind this to a powder in iron mills. The material is comparatively soft, and is easily reduced. Next, to every hundred pounds there is added a certain amount of one of several mixtures, which vary according to the "system" by which the resulting carbon "point" is to be used. This "mixture" consists of various substances, which are weighed out and put into packages by a man who does his work in a locked room, according to formulæ, which he alone is allowed to know. What the substances are even he does not know. The dose of "mixture" having been added to the powdered coke, the two are thoroughly mixed, and the resulting compound is then thoroughly baked. This drives off whatever volatile substances may have remained in the coke, and has important chemical effects; the result being that when the compound comes from the furnace its grains are hard, and very different in many important respects from what they were before.

After the compound has cooled, it is ground at this time in iron cylinders or barrels containing cannon balls. The barrels revolve on their axis, the balls are inside with the compound, and as they revolve the grinding proceeds rapidly and "exceeding fine." We now have a powder made up of small but exceeding hard grains of a substance which is, both mechanically and chemically, very different from the coke which is its chief element. Next it is filled into moulds, each mould being for sixteen points. When filled the moulds are put into a furnace and heated, and then put into a hydraulic press and subjected to an immense pressure. When the pressure is removed the carbon is found to be thoroughly formed and very solid and substantial. Next comes another baking or firing; this is done in furnaces, of course, and in order to exclude the air and prevent combustion the carbons are packed in sand. The details of this part of the process are not communicated to any one.

When the carbons come from the furnace they have become very hard, so hard, in fact, that nothing short of an emery wheel will cut them. They are now inspected, one by one, carefully, and any that are more than one-sixteenth of an inch out of a true straight line are rejected. Next they are taken in hand by a pointer, who grinds one end on a wheel until a blunt point is formed. Next they go to the coppering room, where, after being soaked for a time, they are suspended in leaden vats filled with a solution of sulphate of copper, with copper plates opposite them. The current from a small dynamo is now turned on, and in thirty minutes they are coated with copper to within an inch and a half of the point. The next process is to soak them in water to remove the acid, and then to dry them in a furnace, after which they are packed for shipment.

This, in brief, is the process of carbon making. There are many minor details which I have omitted, and some more important ones which it has not seemed best to dwell upon. My object has not been to instruct anyone in the art, but only to give a general idea to show the several processes, and their somewhat intricate nature.

I have already said that the Boston Company consumes twenty-five tons of coke per week, or one hundred per month. Out of this it is now making, with its factory incomplete, over a million carbons a month. When the work in the way of fitting up new presses and new building furnaces, now nearly completed, is done, its capacity will be fully two millions of carbons per month. It will be asked whether such a number can

find a market. The answer is that, at the present time the Bolton Carbon Company finds it impossible, even by running its factory day and night, to keep up with its orders.

Few people appreciate how rapidly electric lighting is on the increase in this country. Not only are new lighting companies being formed every day, but all the established companies are increasing their plants. All he leading electric companies manufacturingt dynamos and arc lamps are working to their full capacity, which is larger to-day than ever before. Their product goes to increase plants already existing, to establish new plants, and to equip mills and other establishments with isolated plants, and every lamp once started begins at once to be a consumer of two carbons every day. This business of the Boulton Carbon Company, which to-day takes and consumes over a million carbons a month, is growing day by day in the manner and for the reasons I have stated, and it is by no means an unreasonable assumption to say that before another year comes around its capacity of two millions per month will be as fully taxed to fill its orders as it is to-day with less capacity.

It may fairly be said that the success which has attended the business of the Boulton Carbon Company is due to persistent and long-continued experiment, which has cost thousands of dollars, and has resulted in the getting at processes and "mixtures" the secret of which are known only to Mr. Boulton. It is upon these, which result in producing a first-class carbon at low cost, added to "push" and enterprise in the management of its affairs, that the success of the Boulton Company rests.

.... The decision of the Court of Appeals that the Western Union Telegraph Company and the Gold and Stock Telegraph Company are subject to taxation, under the corporation tax law, on the full amount of their capital closes a long and interesting litigation and establi-hes a most important principle. The court decides that the tax is not in theory a direct tax upon the property but a tax upon corporate privileges, and that for purposes of taxation the value of those privileges must be estimated by the dividends declared on the entire capital stock. The decision, of course, is general in its application and extends the scope of the corporation tax law to the limits which have been claimed for it by the State authorities. Each step has been opposed by the corporations, but the issue, we believe, is now ended, and nothing remains for the corporations to do but to submit to the law. The amount involved directly is about $1,000,000, but in its consequences the decision is of much greater pecuniary worth to the people of the State.

We presume that the State will now collect taxes on the dividends of the entire $80,000,000 of Western Union stock. It was recommended to the legislature two years ago by Attorney-General Russell and Comptroller Davenport that power be granted them to make such collections. The decision of the Court of Appeals, therefore, sustains the position taken by those two officers at that time. Indeed, had their advice been followed, the State would have had a valid claim to the interest on those taxes, of which it is deprived by the decision of the court. This matter has passed out of the public mind, and it is only recalled now because Judge Russell's course at that time was made the subject of the most malevolent attacks upon him by a metropolitan newspaper during the recent Senatorial canvass. The Republican State officers of 1882 instituted the litigation in behalf of the State, which has just been successfully concluded. Without detracting one iota from the credit of the present State officers who have diligently prosecuted to completion the work of their predecessors, it is but just that due praise be awarded to those who undertook, in the face of considerable opposition, litigation which has proved of great benefit to the State.

It was announced last Saturday that the second cable of the Mackay-Bennett Commercial Cable Company has been duplexed, which doubles its former facilities. The officers of the company say that the Havre section of the line will be laid next month. This will increase the Commercial Cable Company's service immensely. Go in, Brother Ward, you will get there in good hape soon.

The annual meeting of the stockholders of the Iowa Union, took place Tuesday last. James F. Thompson, was elected President, W. H. Decker, Vice-President, W. A. Leary, General Manager, and A. F. Cutter, Secretary. The company reports 46 exchanges in operation, 1,974 miles, and poles 2,625 miles toll lines. The company is in excellent shape, and is earning 6 per cent. on capital stock of $750,000. The long line business is growing rapidly. Several sleet storms this winter have caused considerable damage to the telegraph and telephone companies. The rapid growth of the business of this company is chiefly due, we think, to Messrs. Thompson and Leary's excellent management.

The Iowa and Minnesota Telephone has moved headquarters to Davenport and occupy offices jointly with the Iowa Union Telephone Company. F. H. Griggs was elected President, James F. Land, Vice-President and W. G. Peesley, Secretary at the annual meeting held last week.

Magnus Volk, the English electrician, has applied through his counsel, Chas. Bulkley Hubbell, of this city, to be admitted to the association of inventors and owners of electric motors who propose to test their inventions in connection with the elevated railway system. Mr. Volk is the proprietor of the Marine Electric Railway at Brighton, England. He is confident that the electric motor can be applied to the elevated railway system with safety and profit.

A correspondence on the subject of secondary batteries in our excellent contemporary, *London Engineering*, led to the statement by a correspondent that M. Plante's paper to the Academy of Science was read and published before M. John S. Sellon had taken out any of his secondary battery patents. This very erroneous statement is corrected by M Sellon, who points out that M. Plante's paper was read to the Academy of Sciences on August 28, 1882, and his patent taken out on July 11, 1882, while M. Sellon's first patent is almost a year older, being dated September 10, 1881 M. Sellon very properly declines to correct other inaccuracies in the statements of the same correspondent before the latter discloses his name. M. Sellon generously supposes that the anonymous writer made these mistakes unintentionally, but people, when rushing into print on such subjects, ought to be careful not to make incorrect statements.

Professor Tyndall on the Sources of Electricity.

The first of a course of six lectures by Professor Tyndall, on "The Sources of Electricity," was delivered, on December 27, at the Royal Institution, Albemarle Street, Piccadilly, London.

Professor Tyndall, in opening the course, said he knew that the delivery of such lectures caused pleasure to others besides himself. It was a pleasure to his colleague, Professor Dewar, and to their noble and good master, the late Professor Faraday, who in the later years of his life lectured to no one else but to those whom he loved to call the juveniles. Nine years ago he (Professor Tyndall) undertook to lecture upon the subject of electricity to boys and girls in that institution. At that time he took what he now called friction electricity, and he devoted the whole of the six lectures to that subject. His intention now was to give them a connected story, so to say, from beginning to end—commencing with the smallest germ, and showing them how it grew up until it had reached the development of the present time. Many of them were aware that the name of this electricity was derived from the fact that first facts were observed by the ancients in the attraction of light bodies by amber. Amber was called, as many of them knew, electron—hence the name electricity, that was, that wondrous power of attraction which amber at first exhibited. It might be mentioned that amber was still found in various parts of the earth. It was found in Europe, especially on the shores of the Baltic, particularly after storms, when it was cast upon the waves, and gathered there. There were also beds of fossil trees. In point of fact, along the shores of the Baltic the amber tree in distant times bloomed; and just as the poplar at the present time oozed out its gum, or the pine tree its resin, so the amber tree in those days dropped its precious gum into the sea; and where the amber had fallen and could be converted into lignite, they there found the amber diffused among the fossil amber trees. The ancients had another story about amber. They considered it a very costly ornament, and paid dearly for it; and, indeed, at the present time, the revenue derived from the sale of amber is very considerable. The ancients told them that the daughters of the sun, for some reason, were converted into poplars, that these poplars wept tears at their sufferings, and that these tears, petrified, became amber. They would find the account in Sir George Cornewall Lewis's History of Ancient Astronomy. He would begin with the first experiment made with amber. He held in his hand a piece of amber made into the form of a stick consisting of the two mouthpieces of pipes fused together. By means of this stick he would show them the attraction of light bodies by amber. Rubbing the amber with catskin, he showed how some bran was attracted by the amber. [Experiment.] The human mind was never contented with merely looking at a thing and seeing that thing occur; they were never contented with facts. Therefore, at an early time, the question occurred, Why did amber attract light bodies? The ancient philosopher was following the irresistible profundity of the human mind when he asked the reason of this. He supposed the amber to possess a soul, and in virtue of this soul attracted these light bodies. This was the theory of the celebrated Newton, the great astronomer and philosopher. There were various other ways of showing this attraction. For instance. [Experiment.] He placed a lath upon a point, and showed how a glass tube, after being rubbed as he had rubbed the amber, acted upon the lath. He ought, however, first to have stated that this attraction of light bodies by amber was the only thing known to the human mind for 2,000 years. Not until the year 1600 was the bond pierced by the celebrated Dr. Gilbert, in the time of Queen Elizabeth. Dr. Gilbert said: "If you look at amber it is a kind of gum. You see insects sometimes entangled in it. It would be very extraordinary if this were the only thing capable of attracting light bodies." Dr. Gilbert therefore set to work, and found a vast number of other substances attracting light bodies, like glass, for instance, in its action on the lath in the experiment he had shown. They might use sealing wax instead of the glass tube he had used. The lecturer then, to illustrate this showed several other experiments with a watch glass, an egg, a piece of sealing wax, and a small wheel. He wanted to impress on them the quality of what was called a scientific mind. It had the quality of looking behind facts They would observe in the experiment that the wheel followed the glass tube about as a carriage followed the horses harnessed to it. The question which a scientific mind asked was, "Is there anything between the glass tube and the wheel!" That was a question which occupied the mind of the great Sir Isaac Newton as to gravitation. He asked himself, "How is it that the sun can control the earth in its orbit?" He was too cautious to express any definite opinion on the matter, but his conclusion was that there was something there which enabled the sun to act upon the earth. In the same way he (the lecturer) now asked them this question, whether anything existed between that wheel and the glass tube? That question was one of the most important that occupied the minds of scientific men. They wanted to know whether there was a medium between that glass tube and that wheel. It was, as he had said, a point which was occupying the minds of scientific men, and perhaps they would not solve it in our day. Another experiment was made with regard to attraction by Sir Isaac Newton, who was a great experimenter as well as a great mathematician, and he was very much taken by this electrical attraction. He made this experiment: He wore a dressing gown; he got a plate of glass and placed light bodies, such as bran, over that plate of glass, on which rested a ring of brass, placing over it a plate rubbed against his dressing gown. Projecting the shadow of the brass upon the screen, the lecturer showed this experiment, and how the bran was acted upon. Incidentally he drew attention to the arrangements he had provided for keeping out of the theater all vapor and moisture, the arrangements being, he observed, to secure dryness, and not warmth or heat. Passing on to the laws of this attraction which they had just seen, he said he would give them an experiment which was first made by a sturdy old fellow, the burgomaster of Magdeburg, in Prussia, Otto Guericke, who invented the air pump. He noticed that when one brought an electrified body to and near a suspended feather, one saw it attracted there. He noticed after it was attracted, and after it touched the attracted body, that it was repelled. [This experiment the lecturer then showed, using the glass tube before mentioned.] He might, he explained, use sealing wax, or shellac, or a variety of other bodies. Showing how the feather was drawn towards a stick of gutta percha and driven away by a glass tube. he stated that in this exhibition they had the first notion of the difference between electricity on the surface of the glass and upon the surface of gutta percha. The one attracted, the other repelled the feather. He would now show them an experiment which he himself first made that morning, guided, of course, by the principles of electricity. They had seen him, he first observed, communicate the electricity upon the surface of the glass tube to the feather, and that when the feather had upon it the same electricity as the glass tube the feather was repelled. Taking a stand and resting it upon the table. he remarked that he wanted something to interpose between the stand and the table which would not allow the electricity to pass from the lath placed upon it to the table. He found this something in a piece of shellac, but he might use common resin or sealing wax, or India rubber. He would, however, use the shellac, and he now knew that any electricity he might communicate to the lath would be prevented from going to the earth. He was forestalling matters a little, but in a few moments they would understand all he was saying. The experiment would be attended with some risk, as when he first made it that morning he wore a different coat, and he did not know whether the coat he was wearing at that time would behave as the coat he wore in the morning did. He then requested his assistant (Mr. Cotterill) to strike him with the catskin, thus electrifying him. At the same time he drew his hand over the lath, explaining that in that way he was communicating to the lath the same electricity which Mr. Cotterill was exciting upon his body. They would observe how the lath followed his hand—a movement he afterwards stopped, observing in continuation that he had communicated to the feather the electricity upon the glass, this self-same electricity proving itself repulsive. In the same way in the experiment he had just given, the electricity communicated to his hand had caused his hand to repel the lath. He would ask them to go fully into this matter with him, because it underlay the whole of electrical science. Sir Isaac Newton found his dressing gown was better for his glass than other substances. It was soon found that the electricity excited depended a good deal upon the rubber—a towel would not excite the same electricity as a catskin. Taking two sticks of sealing wax and balancing one on the cradle, he rubbed the second stick and showed the attraction and afterwards the repulsion of the two substances electrified in the same way. He subsequently repeated the experiment with two pieces of gutta percha, and said he might go on with sulphur and sulphur, two paraffin candles, or paraffin and wax, or he might take ebonite and ebonite. Taking an ebonite comb he passed it through his hair, and then showed how it repelled another ebonite comb, which was balancing in the cradle. Sealing wax was a common substance, and might be taken as representative of the whole class of the so-called resinous bodies.

Telephonic News

*** The Western Electric Company, of Chicago, New York and Boston, held its annual meeting at Chicago on the 22d inst. William S. Smoot was elected president, in place of Gen. Anson Stager, who declined, on account of ill-health, to serve in that capacity any longer. Enos M. Barton was re-elected vice-president, and J. M. Jackson, secretary and treasurer.

*** By observing and comparing the sounds emitted by a telephone connected by leads with two iron bars, stuck into the ground a few meters apart, it is possible to have an indication of the coming weather, sometimes ten or twenty hours in advance. So says *La Franklin*. In case of a thunder-storm, especially, a noise like that of shriveling leaves increases until a flash of lightning occurs, when it resembles that of rain or hail falling on glass.

*** It is estimated that the Bell Company earned for ten months to January 1, the end of the new fiscal year, $1,577,000 net, and that January and February will add enough to the net revenue to make the earnings for the fiscal year, as formerly reckoned, about 18 per cent. on the stock. The company is gradually acquiring control of all of the sub-companies, and the more its dividends accumulate the more it becomes apparent that, practically, the only money to be made in the telephone business is by the parent organization. It is understood that the contract of the Southern Massachusetts Company with the American Bell expires in 1886, and the price of renewal will presumably be 50 per cent. of the stock.

*** One of the underground conduit companies in Philadelphia asks that it shall be taxed only on its buried wires in actual use. This is a reasonable request, which it is to the interest of the city to grant. A company having present use for say twenty conductors, might deem it advisable to put down 100 in order to meet future demands, without again tearing up the streets. The loss of interest on buried capital in such an undertaking is in itself a heavy tax, and besides it is inequitable to tax unproductive property which exists only for public accommodation. If unused wires are to be taxed by the city it may prove more economical to wait until there is actual demand for them, in which case the streets must be frequently torn up.

*** New Year's Day in Paris witnessed the inauguration of an important postal reform. Five telephonic bureaus were opened at well-chosen centers of business or population. The Bank was necessarily the most important and the office of the Grand Hotel gave the greatest facilities to strangers, but Parisians in all directions could avail themselves of the offices temporarily opened near the Madaline, in the Rue de Grenelle, on the Boulevard Malesherbes, and in the great center of the Halles. The public had access to all of them, and the scale of payment was fixed by time, and a charge of half a franc laid down as the unit of payment. This secured five minutes' uninterrupted conversation, with the privilege of ratable protraction.

*** The Nebraska Supreme Court, at Omaha, has just rendered a telephone decision in the case of a man who was refused the privilege of becoming a subscriber to the Nebraska Telephone Company, although he offered to comply with all the requirements usually demanded of subscribers. He brought a mandamus suit to compel the company to permit him to have the use of a telephone upon the usual conditions. The Supreme Court, in deciding in his favor, held the telephone Company to be a public servant as a common carrier, and as such it must treat all persons alike, and that, where no good reason can be assigned for a refusal to furnish a telephone instrument to a person who offers to comply with the regulations, a writ of mandamus will be issued to compel any telephone company to supply such person with the necessary instrument. This decision defines the position of an incorporated telephone company to be virtually the same as that of a telegraph company, or any other corporation for the performance of services at the hands of the public.

*** Some time since a wire was stretched from the Storm King Mountain to the east shore of the river by the Hudson River Telephone Company, for the purpose of establishing telephonic communication with New York by the way of Peekskill and Yonkers. During one of the recent winds the wire from Storm King was broken, and the work consequently delayed. It is the intention of the company, however, to soon stretch another and stronger wire to connect with a wire already erected from Newburgh to Storm King on the west side of the river, and a wire from Cold Spring to New York on the east side of the Hudson. Communication is now had between Newburgh and New York by the local wires connecting Fishkill Landing, Cold Spring, Peekskill, Yonkers and New York. The day is not far distant when Newburgh merchants can order their goods from New York by telephone with nearly as much satisfaction as though there in person. The Hudson River Telephone Company has just contracted with Mr. C. R. Callahan, the stock broker of this city, to erect private wires for him to Port Jervis and Kingston.

*** It is rumored that a trial of the telephone for submarine communication on an extensive scale, is to be made between Halifax, Nova Scotia, and Gloucester, Massachusetts, a distance of 850 miles. Owing to the fact that both theory and past experiments point to the impossibility of telephoning through an ordinary cable for a greater distance than from 50 to 100 miles, we are compelled to receive the report with some doubt until the particulars of the project are before us. There is, however, some reason in the plan recently broached by Professor Graham Bell for enabling two ships to communicate with each other by telephone at sea, without the necessity of having a wire between them. If the current from a dynamo or battery on board one ship (A) be sent into the sea by means of an electrode at the bows and another towed a considerable distance astern, a difference of potential will be set up in the water, which will make itself felt at the other ship (B), provided the latter has a telephone with its terminals connected to the sea at points also widely separated by electrodes of a similar kind put overboard. If the current be rapidly interrupted, a humming sound will be heard in the telephone, and this, again, may be broken up into Morse signals, as in the harmonic telegraph of Mr. Elisha Gray. Thus, in foggy weather, one ship might learn that another was near, and even speak with it. Professor Bell has tried the plan on a small scale on the River Potomac, and found that he could communicate 1¼ miles with it through the water, the source of power being a battery. It may be remarked that if a dynamo be used, such as that for electric lighting on board, the current, not being absolutely continuous, will itself produce a humming sound in the telephone without the use of a separate interruptor such as a battery requires.

*** The Boston *Herald* says that a Lowell paper takes exception to a paragraph published in this column one day last week, and does itself no credit by saying that it was "evidently designed to weaken the confidence of stockholders and the public in the stability of the Erie Telephone Company. It was apparently inspired by some person antagonistic to the company, and contains some statements and implications which will not bear examination." The editor of this column never has written a financial paragraph with "design" to weaken or strengthen a telephone, railroad or other stock, and the paragraph in question was "inspired" by nobody but himself. Nobody handed it in; nobody knew it was to appear but the writer. Paragraphs in this column are "designed" to state the truth as nearly as it can be ascertained. The paragraph stated that the company had a debt of $160,000 to $170,000, which it would require a full year probably to concel on the basis of recent net earnings. The Lowell paper says the debt is overstated, and could be paid in ten months on the basis of the November net earnings, $14,000. That is to say, the debt is $140,000. By this is, no doubt, meant the debt less the value of supplies, say $30,000. Supplies which are wanted for daily use are not a good asset to pay debts with, and, if the gross debt is $170,000, it would take twelve months to pay it on the basis of the November net earnings. The *Herald* intimated that net earnings were being increased at the cost of the maintenance of the plant. This is denied by the Lowell paper. The proof of the correctness of the assertion or denial will appear in future maintenance accounts; meanwhile, it requires a vivid imagination to figure increasing profits from the growth of the telephone business in these times. It was stated on hearsay that the contract of the North-western Division of the company with the American Bell expired in 1886 or 1887, and the theory advanced that the stock of this division would have to be doubled when the contract was renewed. This also is denied, the Lowell paper says, by the Erie directors, who claim that this division has a perpetual contract, while the Cleveland and South-western Divisions have contracts which extend nearly as long as the life of the Bell patents. The South-western Division contract expires in 1889, and the Cleveland Division contract in 1891. The North-western Division has no contract as a division, but only as assignee of one Haskins, of Milwaukee, whose agreement with the Bell Company is open to varied interpretations. It may be perpetual, as the Erie directors claim, or it may expire in 1887, as it is understood the Bell people claim. Whatever it is, there is reason to suppose that the Bell people will ask for 50 per cent. of the company's stock after 1887, and this means doubling the stock. The Erie Company has, as the Lowell paper claims, 2,000 shares of Treasury stock which it might sell and apply to its debt, thus reducing the debt by $40,000. if it can be sold at the current price.—*Ex.*

* * A large number of members attended the annual meeting of the Franklin Institute last week. Many came early in order to cast their votes for officers. President Tatham occupied the chair. Secretary Wahl read the report of the Board of Managers.

The number of new members elected during the year was 510. Sixteen members died or resigned, and thirty-three were dropped for non-payment of dues, so that the gain in membership was 461. The total number of members is about 2,050.

The financial statement showed receipts, including a balance of $657.57 from last year, of $25,509.12, and payments of $18,579.32, leaving a balance on hand of $6,929.80. Thirty-eight lectures were delivered by scientists and professional men during the year.

The report congratulates the Institute on the success of the Electrical Exhibition last year, and continues:

"The board has had under consideration the subject of another exhibition next fall, and application to the Pennsylvania Railroad has been made for a positive lease of the ground for this year, but at this date no answer has been received.

"In anticipation of a favorable answer, the board, after mature consideration, at the meeting held on January 14, 1885, resolved to hold an exhibition, to be known as the 'Novelties Exhibition,' and to be devoted to such recent inventions and improvements in the arts, manufactures and sciences as may be deemed worthy the name. As a preliminary step, arrangements were ordered to procure a suitable guarantee fund."

The Secretary then read his report, which was an exhaustive review of the progress of science and the arts in 1884. It was general in its nature, having to be compressed within narrow limits, but presented all the important steps that have been taken, and touched upon many subjects of interest to the mercantile and manufacturing as well as the scientific world. It was listened to with close attention, and Dr. Wahl was loudly applauded at the conclusion.

An electric light made on a new principle was exhibited.

The tellers appointed to receive and count the ballots at the annual election reported that the following officers had been elected, each receiving about 148 votes:

President—William P. Tatham.
Vice-President—Joseph E. Mitchell.
Secretary—William H. Wahl.
Treasurer—Samuel Sartain.
Managers—William Sellers, Hector Orr, Cyrus Chambers, Jr., Henry R. Heyl, Chas. J. Shain, Chas. E. Ronaldson, G. Morgan Eldridge, Hugo Bilgram.
Auditor—William B. Cooper.
For Representative in the Pennsylvania Museum and School of Industrial Art—William H. Wahl.

Kansas City and Northwestern News.

KANSAS CITY, MO., Jan 26, 1885.

There has been considerable annoyance experienced by the telephone exchange people here during the past thirty days caused by grounded lines—the grounds occurring in the lightning arresters in the cable boxes. The weather has been alternately intensely cold and very suddenly warm, and the thawing process would cover the ground rods in the lightning arresters with moisture sufficient to penetrate the insulation of the magnet wires (connecting cable and line wire over the brass ground rod) and lines were grounded in pleasant little squads twenty-five. The trouble was temporarily remedied by disconnecting the ground wire and, to prevent crosses "jumping," the magnet wires past the central rod. But the problem still remains, although a partial solution was attained by Mr. W. W. Smith, of the telephone company, who soaked the magnet wire in a pail of hot paraffine, and on using this wire, it was found that an unusual deposit of moisture was necessary before the insulation obtained was penetrated and destroyed. Some telephone companies, I notice from the report of the National Exchange Association, have but little fear of the elements and do not have to be so watchful of their lightning arresters, but out in this locality where an electric storm is liable to occur any day in the year, omitting three mid-winter months, the best precautions become necessary in protecting the central office; and then the condition of the electric light work in the majority of western cities is such that these heavily charged lines become crossed with telephone lines very often, and then fun really begins. The exchange here has had several instruments burnt out by the electric light currents, and recently a cable box suffered the same fate, the exchange being saved, probably, by the excellence of the lightning arrester and ground at the cable box.

E. L. Luther, of Indiana, has been appointed manager of the Leavenworth, Kansas, Telephone Exchange.

The *Daily Journal*, published a very complete and comprehensive review of this city in a 20-page issue, with map of city and suburbs, January 1st, and in it occurs the following notice of the telephone company:

"The work of reconstructing the Kansas City Telephone Exchange, which was commenced in 1883 by the Missouri and Kansas Telephone Company, has been carried to a successful close during 1884, and all portions over a widely scattered city and suburbs, are now brought into close communication by means of the telephone. During '84 about six miles of poles have been constructed at a cost of nearly $30,000, and new and latest improved switch-boards and central office appliances added to the exchange which numbers at the close of the year 900 subscribers located chiefly in Kansas City, Mo., and Kansas City, Kas., with a few each in the adjoining suburbs of Argentine, Armstrong, Armourdale, Wyandotte, Westport

and Rosedale. There is also a small branch exchange at Independence, Mo. The main growth of the exchange—which has increased from 400 subscribers January 1, 1884, to 900 January 1, 1885,—has been among the business houses of the city, where the improved and prompt service of the present management has made the telephone of peculiar value in a city of so uneven surface as this, in aiding in intelligent and quick transaction of business. The growth of the exchange speaks for itself in this respect.

"The company in bringing their wires into the operating room, located on the fourth floor of Wales building, Sixth and Delaware streets, use cables of 100 wires each, which are found to work admirably for certain distances, the longest cable extending about six blocks from the central office. The force required at the operating room during business hours is composed of fifteen young ladies under control of the chief operator, the sex of the telephone operator having been finally and satisfactorily decided in favor of the feminine. At night three young men are on duty until 10 o'clock and two remain all night. Not the least of the work of the telephone company here is the fire alarm service furnished the city, and in every instance proving the great value of the telephone, when properly managed in this respect.

"The long lines—known in telephonic parlance as "extra-territorial"—extending to Lawrence, Eudora and Topeka on the west and Leavenworth, Atchison and St. Joseph on the north, have been carefully watched and improved in every way possible, and are kept busy from morning till evening, conveying business conversations between the cities named. These lines were constructed during the close of 1883, but the newness of that class of business made it awkward to handle at first, and it was not until 1884 that all the defects were discovered and remedied, and the lines are now fully appreciated as a valuable aid to the commerce of the West.

"If the company is able to keep the service where it is to-day there is little reason to believe that the growth will stop, but much more probable is it that the present average increase of thirty subscribers per month will continue during the present year."

The Bell Telephone Company of New Mexico has been purchased by the Colorado Company. This will undoubtedly benefit the telephone interests of the Territory.

Mr. Charles S. Smith, who went from Indianapolis to Salt Lake City recently, has been selected as secretary by the Rocky Mountain Telephone Company in which position he will do himself and the Smiths in general full credit.

At a recent meeting of a local electric company, known as the Henry Electric Company, the following officers for the year were elected: President, H. L. McElroy; vice-president, John H. Reid; secretary S. J. Van Dorston; treasurer, T. S. Case. The company has been formed for the purpose of testing a new method of propelling street cars by electricity, which Mr. J. C. Henry, of this city, has invented. The invention will be thoroughly tested in this city within a month or two.

O. B. Clark, formerly manager for the Central Union Company, at Springfield, Ill., (one of the numerous cities that claims the largest percentage of subscribers to inhabitants, possessing 600 to 20,000) has accepted a route agency with the Adams Express Company, with headquarters at Parsons, Kansas.

Eastern inventors had better be on the alert. The West is coming to the front with inventions that are not to be frowned down. In addition to a telephone switchboard, insulators that need no tie wires—something new and unique, by the way—signal boxes, etc., several other valuable inventions are being agonized over by our cow-boy electricians. I know of two very competent men who have nearly worked out some schemes of a practical nature that will, if successfully carried through, make some radical changes in the telephone world. One is a magneto transmitter. Look out for it.

J. W. Connorton, of Chicago, the great telephone directory publisher of the West, spent a day as well as some loose change in Kansas City last week. "John" is a very genial gentleman, and had with him as solicitor, collector and right bower in general, Lieut. L. Tobias, easily and naturally graduated to "Toby." When Connorton tells one of his good stories, and appeals to "Toby" for itf confirmation with an "Eh, Toby?" in an elevated voice, the answer from the loyal fellow (who is partially deaf and never understands a word of the story) is always a most emphatic nod, and "Yes, indeed, sir." That settles it, and Connorton's stories pass at a premium. But this is not electrical,—as your Mr. Hovey says when he catches himself describing a lady's ball costume.

Col. Geo. L. Beetle, of your city, suddenly "bobbed up serenely" in Kansas City, a few days ago. He delivered a lecture before the Y. M. C. A., and then went to Omaha.

General Thomas Sherwin, auditor of the American Bell Telephone Company, visited Kansas City, on the 17th. Since his visit of eighteen months ago, many improvements have been made in Western exchanges, all of which Mr. Sherwin was pleased to notice.

Mr. George M. Myers, general manager of the Pacific Mutual Telegraph Company, informs me that the company has just opened offices in 116 cities and towns. The Pacific Mutual has united with the Baltimore & Ohio, and the Bankers and Merchants' Telegraph companies. The company feels somewhat triumphant in that it has defeated thirty-one injunction suits brought by the Western Union Company, backed by the Gould system. For the first time Texas will enjoy the benefits of competition in the telegraph business. The new company has reduced the rates 25 per cent., and has been promised a large share of the telegraph business. Among the important offices are Houston, Galveston, San Antonio, Sherman, Fort Worth and Waco. BI-POLAR.

.... The London *Electrician* gives the following statistics of the telegraph business in Europe:

In Great Britain on March 31, 1881, there were 4,015 post offices and 1,423 railway stations open for telegraph work, making the total number of telegraph offices within the United Kingdom 5,438, as compared with 2,488 under the telegraph companies. The date of transfer from companies to the Government was January 29, 1870, so that in the course of eleven years the number of offices had been more than doubled. On taking over the telegraphs the post office commenced with 5,651 miles of telegraph, with 48,999 miles of wire. At the date above mentioned these numbers had increased to 26,319 miles of line, with 121,052 miles of wire. The number of words delivered during the year ending March 31st, 1881, was 327,707,407, while the work done for the Government itself was valued at £19,479. The number of the telegraphists employed by the companies was 2,514, of whom 479 were women, the number of messengers 1,471, while the Government had respectively 5,611; of these 1,536 were women, and 4,648 messengers. These latter numbers are exclusive of those persons indirectly employed, such as those paid by postmasters out of allowances for assitants.

In Germany telegraphy has here from its beginning been a State institution. The rates for ordinary telegrams are: (1) An initial charge of 0.20 mark for every telegram; (2) within the empire a charge of 0.05 mark per word; (3) for city, *i.e.*, local telegrams a charge of 0.02 mark per word. For urgent telegrams, to which precedence is given, a threefold charge is made. For press telegrams in the daytime the charge is 20 or 40 marks per hour, according as the Morse or the Hughes instrument is used; at night the rate is but half this amount. The value of Government messages in 1880 was about 100,000 marks.

In France the telegraph is a State institution. The tariff is 5 centimes per word, with a minimum of 50 centimes. The press messages are at the rate of 24 francs per hour for the use of a wire erected with the assistance of the paper, otherwise 50 francs per hour. In Paris the normal tariff is reduced 70 per cent. for messages despatched either by pneumatic tubes or on the newspapers' own wires. The value of the press messages in 1880 was 1,722,683 francs.

In Austria the telegraphs are State property, but certain concessions have been granted to railways, to Vienna, to companies in local capitals, to five telegraph lines, and to cable companies. The tariff is 28 kreuzer for the first two words, and 2 kreuzer for each word after. Local—*i.e* in same town, messages half that rate. For urgent telegrams a threefold rate is charged. Press telegrams at night pay 5 florins for 500 words, and 1 florin for each additional 100 or part thereof.

In Hungary the State took over the telegraphs in 1867, when there were 650 stations, 12,271 kilometers of line, and 36 311 kilo meters of wire. In 1880 the respective figures were 1,083, 15,525, and 55,137. The tariff seems similar to that of Austria, 24 kreuzer for two words, and for each word after 2 kreuzer.

In Russia the State owns the telegraphs. The tariff varies with distance. The first zone embraces Russia in Europe, as far as the meridian of Ekaterimbourg, including the Caucasus; the second, Russia in Asia, as far as the meridian of Strelinsk, including Turkestan; and the third, extending from that meridian to the extreme limits of the empire. Each of these three parts is subdivided into three zones. The first measures a distance of 200 versts, the second 1,000 versts, and the third comprises all the space beyond the second. The tax is based on a minimum of ten words; for this minimum the charge is 30 copecks in the first zone, 60 copecks in the second, and 1 rouble 20 copecks in the third. For each supplementary tax must always be increased to an even number; in the second zone, 5 copecks for each supplementary word, and in the third 10 copecks.

.... "During the past three weeks I have been unable to use my pen," said Superintendent Walker, of the city's electrical department in Philadelphia, "and have been compelled to dictate my correspondence. I am suffering from telegraphers' paralysis. My right arm is useless, rendered so by working in and around batteries, testing their strength, and from the repeated shocks I have received. Any one handling the keys of an operator's board is subject to this ailment. It is first observed in the muscles of the arm, which become benumbed after a hard day's work. A few month's after the first shock the stoutest operator will succumb. My physician has had me under treatment for a month, but as yet does not appear to have benefited me much. Any muscular work, such as lifting heavy packages, I can readily accomplish, but it is only with difficulty that I can button my coat. Last summer our chief operator complained of a pain in his arm, and I insisted upon his taking a complete rest, and since his return he has not been attacked. On the night of election, when the returns came pouring in on us, one of our best men was struck and was compelled to give up." Superintendent Gill, of the Western Union operating rooms, said that many men after serving the company for years were compelled to throw up their positions on account of this form of paralysis. Many mistakes have been traced to the same source, as the slightest pressure on the key will produce other than the letter an operator wishes to indicate. He will often charge the mistakes to a defect in the machinery, but in the end must admit of his inability to work. When an operator is first attacked he will simply attribute it to overwork, but he soon finds that his keen sense of touch has disappeared. In nearly every case it is a first-class operator that is afflicted. A good transmitter is paid a large salary, but must keep continually working at his board, while a second or third-rate man has many resting spells which allow him to stretch his arms.

TELEGRAPHIC

.... It is stated that there are no less than 7,702 Morse instruments in operation in France, and that the Boudet instrument transmits 1,800 telegrams daily.

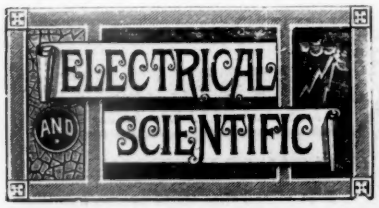
.... Friends of the Bankers and Merchants' Telegraph Company say that it will come out all right; that there is a good basis for the company, and sufficient means will be forthcoming to tide it over the present crisis, when it will have a great future.

.... The Baltimore & Ohio Telegraph Company announces that it has completed its lines into Texas, and about sixty offices were opened for business yesterday. More offices will be added on its own lines in a few days, and also connections made with other lines in Texas, the Mexican and the Central and the South American cables. This is the first time in the history of Texas that Texas has a competing telegraph company within its borders. The day rate from Baltimore to the prominent points in Texas will be 75 cents; the night rate one-half the day rate.

.... In regard to the tax decision of the court of appeals against the Western Union, the entire amount to be paid by the Western Union is $170,000, and not $1,000,000, as some of the papers say. But the case will be carried to the Supreme Court of the United States, and even if it should stand it would only amount to $120,000 per annum if six per cent. dividends are paid. A considerable portion of this $120,000 they have always paid, and it is only the excess that is involved.

.... The Dominion Government is being strongly urged by several prominent members of Parliament to secure absolute control of the entire telegraphic system of Canada. The choice seems to lie between the purchase of existing lines, at a fair valuation upon stock quotation, or the erection, at the national expense, of an entirely separate and independent system, in either case accompanied by a considerable reduction of present rates. A reduction of ten cents for ten words throughout the Dominion has been suggested by practical men, but these and other matters of detail can only be ultimately decided on after the most careful consideration. At present the shares of the Montreal and the Dominion Telegraph companies are quoted at 113½ and 80 respectively, under guaranteed lease dividends of 8 per cent. and 6 per cent. respectively. A clause in the existing contract, however, makes such guarantee terminable at twelve months' notice. It is, therefore, urged that the Government should, without avoidable delay, assume possession of the entire system under some equitable agreement or erect its own lines.

.... Superintendent Smith of the Fire Alarm Telegraph has informed the Fire Commissioners that the damage to the department wires recently was caused by contact with an electric light wire in Broadway, between Liberty and Cedar streets. The position of the fire alarm wire at that point had been changed by some unauthorized person. The following statement appears in Mr. Smith's report: "The crowded condition of Broadway since so many electric light wires have been strung thereon makes it extremely difficult to prevent contact between the wires. It is hoped that some relief will speedily be furnished, particularly on that thoroughfare. I would recommend that our Broadway circuits be re-run with insulated wire, particularly at the points where necessary to render them more secure. The fire in the telegraph office resulted in thirty-five alarm boxes being thrown out of service in the most dangerous locality of the city for a period of thirty minutes, and in the event of a fire breaking out in that district it would have certainly resulted disastrously, as all communications with our headquarters was cut off.



* * A German engineer has invented an electric target on which a hand indicates the exact point where the bullet strikes it. That ingenious arrangement will do away with human pointers, and effectually prevent many accidents to life and limb.

* * M. Planté has now made some accumulators in which the lead plates assume a horizontal position, and having a contact piece turned up at right angles. With this arrangement there is no difficulty in rolling, nor of the plates bending and coming into contact.

* * M. de Sainte Marie makes the positive pole of lead surrounded by chlorate of lead and the negative pole of zinc, while the liquid contains chloride of lead, presumably for diminishing the resistance Under the influence of the electric current, the chlorate of lead is reduced to metallic lead, which is deposited in the form of sponge.

* * A new important discovery of borax has just been made near St. Bernardino, Cal. It is a very large ledge, and assays 54 per cent. of pure borate of lime. The discovery is likely to interfere with the monopoly hitherto maintained by a wealthy San Francisco firm, which has succeeded in controlling the supply of borax.

* * The London Metropolitan Railway Company (the underground line) has adopted an ingenious electric station indicator lately patented. By this device the name of the station which the train is approaching appears in each compartment simultaneously The apparatus is said to be remarkably simple and easily managed.

* * For giving warning automatically of any undue heating in an electric conductor, M. Thommasi has invented an instrument consisting of a wooden block with cylindrical hole, fitted with a spiral spring, which supports a small copper cup, filled with stearine or paraffin. A short copper wire is bent angularly so as to project above the cup, the part which projects resting on the stearine, but in its absence on the cup, thus making contact. The short copper wire is put in the circuit by two binding screws, one of which, as also the spiral spring, is connected with an interposed bell, in a local circuit with separate battery.

* * Electric batteries are multiplying. A new primary cell, devised by Dr. Pabst, of Stettin, operates by the consumption of iron, the electrodes being carbon and wrought iron dipping into a solution of chloride of iron. This cell is attracting much attention in Germany, and it is expected to prove valuable in domestic electric lighting. In another primary battery—that of Profs. Bartoli and Papasogli—the peculiarity is that the carbon is consumed, the electrodes being platinum and carbon, and the exciting liquid hipochlorite of soda.

* * In the accumulator of M. Parod the plates, instead of being simply composed of lead sheets, like those of Planté, contain a copper core, hermetically inclosed in a leaden cover, which constitutes the secondary plate proper, and which alone comes in contact with the exciting liquid. In the middle of this core, which is a good conductor, the primary current unites, simultaneously, all the secondary plates, every portion of which develops an equal electro-galvanic action. The absorption of the primary current is, therefore, excessively rapid and regular, and the formation uniform. These secondary plates, with conducting core, which are capable of any form and arrangement, are contained in a cell of ebonite or other similar material, divided into two parts by a porous diaphragm, in such a manner as to avoid the oxidization of the electrodes and the transposition of the salts —*Il Giorno, Rivista dell' Elettricita.*

* * A writer in a French contemporary records the very successful use of a concrete for foundations, made partly with asphalt. It is said that the slight elasticity or hard, rubber-like flexure of minute range of this material makes it superior to the hard foundations for engines and machinery where masonry or concrete is used. It acts to a small but useful extent as a moderator of shock.

* * Hitherto the £100,000 Bank of England notes have been considered the largest notes extant. The princely family of Starhembergs are the possessors of a single bond of much greater value—namely, of the face value of 1,500,000 florins (about £150,000), at which figure they sold, some years ago, their interest in the vast estate in the Widen in Vienna. The bond, which nominally yields an annual interest of 75,000 florins (silver), is deposited with the Vienna District Court.

* * According to Onimus batteries containing solution of ammonium chloride, zinc chloride, etc., may be converted into dry piles by mixing these solutions with plaster of Paris and allowing the mixture to solidify. If mixtures of ferric oxide or manganese peroxide with plaster of Paris are employed, the electromotive force is slightly higher than with plaster of Paris alone, and when ferric oxide is used the battery quickly regains its original electromotive force when the circuit is broken. When the battery is exhausted the solid plaster is simply again moistened with the solution.—*Jour. Chem. Soc.*

* * Professor Tyndall, in a recent lecture on electricity, produced the clothes of a man who was taking refuge under a tree when it was struck by lightning. It was a foolish thing, he observed, to go under a tree during an electric storm, unless a person stood some distance from the trunk. In this particular case, however, the man's clothes were very wet, and, though they were very much torn, they formed a sufficiently good conductor for the lightning, and he escaped with his life. Had his raiment been dry he would inevitably have been killed. Producing the man's boots, the lecturer pointed out that the uppers were torn to pieces by the electric fluid in its anxiety to reach the earth ; but the sole, into the construction of which iron largely entered in the shape of hobnails, formed a good conductor and was not hurt.

* * Referring to our recent note on this subject, we glean some more detailed information from the *Bul. Int. des Tel.:* In this system, devised by M. Em. Courcelles and M. Alph. Elu, the heat is produced by the current passing through a certain number of small lead plates arranged transversely in an ordinary foot-warmer. The plates are all in a shunt circuit, the current, led by two iron wires, being thus evenly distributed. In the trials which took place at M de Meritens' works the current was generated by a Gramme machine, and traversed five foot-warmers, 1.8 meter long, 22 cm. wide and 5 cm. thick (71x9x2 in.) coupled in series. The current was 50 volts at 24 amperes at the terminals of the dynamo, so that the energy given out was about 1½ horse-power per second. Consequently, *le jeu ne vaut pas la chandelle ;* but in another arrangement, patented by M. Thommasi about a year ago, the current passes through spiral metallic conductors in each foot-warmer, previously filled with some substance possessing great latent heat on melting, such as crystallized acetate of lead or hyposulphate of soda, and plunged into boiling water before starting.

* * Before the Paris Academy of Science, the other day, M. A. Crova dealt with the photometric value of an intense focus of light (solar or electric), the determination of which, he considers, requires the practical realization of the following conditions: 1, Comparison of two lights of different tints; 2, valuation of the tint by means of a numerical factor; 3, determination of the photometric ratio of a very intense source as the function of a relatively feeble standard. The first condition may be realized by using a solution of perchlorate of iron and chlorate of nickel, across which the photometric screen is observed. In practice, the tint may be represented by means of two successive photometric determinations—one, obtained by observing Foucault's photometric screen through the solution 580, gives the ratio of the intensities; and the other, made by placing before the eye a glass reddened by oxide of copper, which lets pass radiations comprised between 726 μ and 752 μ, with a maximum of 650 μ, gives a ratio so much inferior to the former as the tint of the light compared with the carcel flame is whiter. The quotient of the former determination by the second permits of distinguishing the tint, which is so much greater as the light is whiter. Lastly, the third condition may easily be realized by the use of a special photometer.

* * A simple and convenient application of Lippmann's mercury galvanometer to the measurement of the intensity of a magnetic field has been made by M. Leduc. Lippmann's galvanometer is based on the principle of his electrometer, in which the motion of a column of mercury in a capillary tube, with dilute sulphuric acid in contact with one of its extremities, is made to indicate on a scale the difference of potential established between the mercury and acid This principle is applied by Lippmann to the measurement of a current by inclosing the sensitive column in a magnetic field, and M. Leduc has modified the apparatus so as to render it suitable by a kind of reverse process to measuring the strength of the magnetic field in which it is placed. The apparatus consists of a vertical tube containing the Lippmann mercury column, which is traversed by an electric current. Communicating with its sides are two other vertical tubes constituting a manometer, one having a graduated scale attached. The mercury ascends both these tubes to a level at the middle of the scale attached to one of them. This is the zero position of the manometer. When, however, the instrument is placed in a magnetic field, the mercury column is displaced, and the manometer index column shifts up or down the scale according to the direction in which the electric current is flowing, and the polarity of the field. M. Leduc constructs apparatus of different degrees of sensibility—one, for example, measuring a field up to twenty C. G. S. absolute units of intensity, another measuring a field ten times feebler Such an instrument, if it prove as practicable as the inventor claims, will be useful for measuring the intensity of dynamo-magnetic fields.

Secondary Batteries.

In a recent number of *Engineering*, the correspondence to which we have already adverted is resumed, "Electrolyte" saying, in answer to Mr Sellon's letter: "Respecting his claim to roughening plates, there are manifestly several ways of doing this. The plate may be roughened by scratching, as is sometimes done. It may be made by casting on a rough surface. It may be corroded by immersion in nitro-sulphuric acid (not nitric acid alone, as Mr. Sellon states, and this appears to make a great difference), like Messrs. Parker and Elwell; or, as by Planté's method, the surface may be eaten into by the alternate electrolytic oxidation and reduction of juxtaposed plates in a bath of dilute sulphuric acid. In view of all these various modes of action, I think the method used requires at least some specific description, or, anyhow, more than mere general allusion. Now, the last-named process was minutely described by Planté, who specially bears upon it in his directions for the construction of his cells, and, although I am not aware that he ever took any *patent* in this country, still his paper to the Academy of Sciences was widely made public here, and I read the whole account published in English at the time of the first appearance of the Faure battery, long before Mr. Sellon had ever taken a patent for secondary batteries. His claim to priority, therefore, falls to the ground. Had Mr. Sellon limited his claim to any *one* kind of roughening differing from that of Planté, and not previously published, I can imagine that he might have formulated a holding claim; but as it is, with its attempted comprehensiveness, it becomes *nil*, and is but one more illustration of the truth of the old adage, "*Qui trop embrasse mal etreint.*" Again, an example of insufficient protection through loose wording is to be found in his patent, No. 2,818, 1882. He there specifies in particular the fashioning of plates with conical holes, which he fills with the active material, or, to speak more exactly, gives to these holes shapes which he illustrates by drawings, so that the active material may 'keylock' into them, and be prevented from falling out. Now, this, in the first place, obliges Mr. Sellon to use plates of considerable thickness, accounting, in some measure, for the great weight of his battery, and, in the next, it does not obviate the use of straight holes with sheets of felt, or some other arrangement to prevent the cylinders of active material from falling out if employed by any designing persons wishing to evade his patent. In face of the illustrative drawings, which prove Mr. Sellon never to have entertained such an idea, it is doubtful whether he could even plausibly uphold an attack for infringement again t any one using pegs of active material with heads like nails stuck in a plate with holes to fit them. As to the second point which Mr. Sellon raises, viz., the comparison of the Faure-Sellon and the Parker-Elwell batteries, I am not able to speak with enough certainty as to their respective working to be able to pronounce upon the figures Mr. Sellon gives, but, corroborated as they are by the letter of so great an authority as Mr. Reckenzaun, of course I look on them as both impartial and moderate. They do not, however, prove so much that the former gives a high efficiency as how lamentably deficient the latter is in this respect This must and will always be the case, I fear, while we are driven to use a metal of so high an atomic weight as lead to produce the active material of secondary batteries. We can only, while this is so, aspire to reducing the weight of the support. I suppose the preference of some electricians for the Parker-Elwell battery lies in the fact that it is particularly useful where a rapid discharge of high power is desirable, for in this respect I have understood it excels all others. Also I have heard complaints that the Faure-Sellon battery rather loses with age, whereas the Parker-Elwell gains thereby. Also that the studs of active material swell and then get loose, and drop out in the Faure-Sellon battery. I do not know whether these complaints are well founded, but, as my authority is a very high one, I am prone to credit it."

Mr. Sellon, replying to the preceding letter by "Electrolyte," remarks that the latter "has fallen into an error—I can fully believe an unintentional one—which, however, governs the chief of his premises. He states that M. Planté's paper to the Academy of Sciences was read and published *before* I had taken out any of my secondary battery patents. The date of my first patent (the one referred to throughout this correspondence) is 10th September, 1881. M. Planté's patent was taken out nearly a year later, viz., 11th July, 1882, and his paper to the Academy of Sciences was read August 28th of same year. Other points of 'Electrolyte's' letter are equally (I have no doubt as unintentionally) at variance with facts, but before being at the pains of discussing them for his edification or that of others who may be interested with him, I would ask him as a matter of courtesy to favor me with his name."

Mr. F. Geere Howard writes: "In the correspondence now going on between two rival secondary battery manufacturers, there seems to be an endeavor to prove that *their* particular form of cell is the better, both as regards weight and efficiency. Now I have found that a great variety of accumulators are required, and that no one form in the market is suitable for all requirements. For example, when they are used simply as a safeguard against a temporary breakdown in an installation through the breaking of a belt or the heating of a bearing, all that is required is a battery that has a very high discharge for a short period. Now the 'El-

well-Parker,' or properly 'Planté' type, *will do this* and the 'Sellon' *will not*, unless the cost of the latter is three times that of the former.

"Again, when an installation has to be worked by accumulators alone during a run of five or six hours, through the engine only being available during the day time, the form most, and I may add only, suitable, is the 'Sellon.' This battery also is the only one at present available for tramcars or boats by reason of its great storage capacity per pound of lead; it being at least double that of any other present form. But the life of these cells being very short unfits them for lighting purposes.

"Then, again, when batteries are required for use as regulators only, and not for storing—for instance, when gas engines are used or steam engines with varying loads, the 'Planté' form is the better of the two, as there is less fear of its getting out of order, though both forms are here applicable. For this purpose, also, I have found that cast lead plates, preferably with transverse ribs (to give them stability and at the same time to keep them as thin as possible), give extremely good results, and this at a very moderate cost indeed, far below that of any accumulator at the present time available, besides having at the same time all the qualities of the best and most expensive. Of course its storage capacity for some time is practically *nil*, but this is not necessary, it only being used for steadying the lights, and for this surface and not capacity is required.

"From this I hope that I have made it sufficiently clear that there is no one form of accumulator that can be used for all the purposes for which they are required, and to put briefly the advantages of the two types, the 'Planté' form will *discharge* at a much higher rate, and is less liable to get out of order, whilst the 'Sellon' form is capable of receiving a much higher rate of *charge*, because it has a greater thickness of working material, and also stores a greater amount of electrical energy in a given weight. As regards the durability or life of either of these forms, it is impossible to give any definite data or results. Manufacturers *say* that their batteries will last a number of years, but this unfortunately has not as yet proved to be the case.

"Mr. Sellon takes to task Messrs. Elwell and Parker about the cost and weight of their battery over his, but it should be pointed out that he has taken the cost of their small circular cell (25s.), which is far more expensive in proportion to their one horse-power cell (having a useful storage capacity of 300 ampere hours) sold at 60s. If Mr. Sellon wished to make a comparison in prices, taking the 'Elwell-Parker' circular cell for a standard, he should, I think, have quoted the Electric Power Supply Company's small cell also, say the one sold at 16s, having a capacity of 35 ampere hours, thus bringing up the cost to £7 instead of £3. Lastly, as regards the weight of batteries, I think that for lighting purposes all electrical engineers will agree with me when I say that weight is *not* important, but durability and reliability are."—*London Electrical Review.*

Application of the Electric Light at the Angers (France) Slate Quarries.

In 1832 the Societe des Grands Caneaux undertook the first subterranean exploitation of the important quarries of Fresnais.

The first gas-works were erected in 1847 at the Fresnais Quarry for lighting chamber No. 1, and consisted of one cast-iron retort and one gasometer. When the possibility of sending the gas down to a depth of 650 feet was discovered, and when the superiority of this mode of lighting the subterranean chambers was recognized, the works in the course of the year 1855 were enlarged and equipped with two furnaces of three retorts each—each having two gasometers, and the most approved purifying apparatus connected with it. The cost of this establishment was about $6,000. This lighting by gas, however, served only for lighting up the subterranean chambers in a general way, as well as the shaft, but did not suffice for the work of the miner, who was obliged to have constantly beside him his hand lamp. Thus the expense of the oil had to be added to that of the gas The improvement effected by the use of the gas, however, was considerable. It allowed the miners to move about without danger, and permitted the superintendents to keep surveillance over the work in progress. The light was, doubtless, a little diffused, but it was sufficient to allow the walls and vaults of the chamber to be seen, and thus it removed that natural apprehension of danger that the miners were apt to feel when working in darkness. The slate companies, however, notwithstanding these improvements and the great cost of the same, began at once to look into the merits of the electric system of lighting as soon as this entered the domain of practice. Some practical tests were made about eighteen years ago; but, owing to a failure to come to terms with the Alliance and other companies, no definite action was taken until 1878. At this period occurred the Paris Exhibition. As a consequence of the economical results obtained with the electric light at this exhibition, and of the improvements introduced therein by the use of the Gramme magneto-electric machine, the Slate Quarry Commission took up the question anew, and decided, on the 30th of August, 1878, that an exhaustive trial should be made with these machines at the Fresnais Quarry. After several months spent in determining on the best practical arrangements to adopt for the motor, the lamps, and the electric conductor, the problem was solved by M. Blavier, the engineer, in a manner which left little to be desired. An expansion engine of a nominal 16 horse-power was installed, along with two generators, for driving the six magneto-electric machines necessary for lighting the three subterranean chambers of the quarry. New conducting cables were made, partly of seven No. 18 copper wires, weighing about 5.5 ounces to the foot, and having a section of 2.5 square inches, and partly of nineteen No. 13 wires, weighing about 4.5 ounces to the foot, and having a section of 2.3 square inches. These cables, which were 1,150 feet in length, were not covered externally, experience having shown that a wrapping of tarred flax deteriorates very rapidly, and thus proves more injurious than useful. The gas-coke carbons of the lamps were replaced by artificial carbons which were more homogeneous, not so fragile, and which gave a more beautiful and regular light. With these various improvements successively introduced, chamber No. 10 of the Fresnais Quarry has been lighted for the past three years without any other interruption than that of two hours' stoppage out of the twenty-four, in order to give the motor and the other apparatus the necessary attention to keep them in order. The daily consumption of coal has been reduced precisely one-half. The light furnished by two lamps, without reflectors, placed at about 35 feet from the end excavation, and on each side of the gallery, is bright enough to render possible all the work done over a surface of more than 6,000 square feet without the aid of oil lamps. The light possesses more steadiness than gas, which was nearly always extinguished at the moment any blasting took place: and, finally, it gives off neither smoke nor any deleterious gases, so that the atmosphere of the chamber is rendered purer and more transparent. The results claimed, then, are very important, regarded from the standpoint of exploitation, and they are none the less so from an economical point of view.

The lighting of a subterranean chamber of 6,000 square feet of surface, like the one just mentioned, requires the use of the following electrical apparatus: Two Gramme machines, three Serrin lamps and a box of accessories, the whole costing, say, $800 to $900 (estimated at French prices). To this must be added the value of the electrical conductor, and which varies according to the length and section, and the value of the motor employed, which also varies according to the type adopted. The expense of the system, as employed at the Fresnais Quarry, per day of twenty-two hours, is (including interest on the amount invested) about $10, or one-tenth less than that of gas when the relative intensities of the two lights are taken into consideration. The economical advantages, then are very great, but only on the express condition, that there is need, as in the above-named quarry, of a like quantity of light. For smaller works than these an expense of $10 per day for light would be inadmissible.

—— The English Brighton Company have succeeded in solving the problem of how to generate electricity by the rotation of the axles of the carriages for the lighting of trains, and have now fitted with this beautiful light trains on their South London line.

—— The Brush Electric Company, of Cleveland, held its annual meeting on Monday last, when the following directors were chosen for the ensuing year: G. W. Stockley, J. J. Tracey, Charles F. Brush, J. W. Cary, M. D. Laggett, J. Potter, and W. F. Swift. After the stockholders' meeting the directors met and re-elected the following officers: G. W. Stockley, President; J. J. Tracy, Vice-President; W. F. Swift, Secretary, and J. Potter, Treasurer. The directors declared a dividend of one per cent. on the capital stock.

—— There is some talk of the power of lighting Paris by electricity being transmitted from distant parts of the River Seine. The Compagnie du Chemin de fer d'Orleans has established an electric motor at Vitry, for use in its vaults. The steam engine placed at a distance of about 180 meters drives an electric generator No. 5, which, at a speed of 1,100, gives a current of a tension somewhat under 140 volts. The electric motor in the vaults is of the No. 3 type, and develops a power of 50 kilogrammeters. By the latter a rotary pump for mixing and filling wine, and a bottle-cleaning machine, are driven. The installation is stated to be very successful.

—— The dynamo machines in the Edison central station, New York, were started in September, 1882, and have been running continuously, night and day, ever since, with the exception of one stoppage of about two-and-a-half hours, caused by carelessness. They supply electricity that is used in motors as well as in lamps. The price charged is about the same, it is said, as that for gas at $2 per cubic 1,000 feet, and last year the company, on this basis, earned three per cent. on the capital invested. The earnings of each lamp are a little over one cent per hour, but they average less than 2½ hours per day. The cost of production is about three-fourths of a cent per lamp per hour.

—— The Brush Company has recently manufactured a remarkable electric light for use in the British Navy, orders having been received to furnish the British Board of Admiralty powerful lights for use in the Portsmouth and Chatham dockyards. It has 100,000 candle illuminating power—fifty times greater than an ordinary electric lamp for street lighting. It is designed to be used in night attacks and in discovering submarine torpedoes. A forty horse-power engine is required to produce the light; the carbons used are two and a half inches thick. The intensity of heat generated between the carbons is 500,000 degrees, one-ninetieth of the estimated heat of the sun. It is calculated that, with an ordinary reflector, a gleam of light can be cast so powerful that a person fifteen miles away can see to read by it.

—— Most visitors to Paris know that, if they purchase goods to a certain amount at the Magazins du Louvre, they receive a small india-rubber balloon, stamped with the word "Louvre," which serves the double purpose of amusing the children and advertising the said gigantic drapery establishment. Now, the air pumps, which inflate the hundreds and thousands of balloons, require a certain amount of power, and the many sewing machines a still greater amount. For these two purposes the Compagnie Electrique has installed one of their No. 5 generators, with a No. 5 normal motor for driving the sewing machines, and a No. 3 motor for the air pumps; and at the branch establishment in the Avenue Rapp a generator and two motors have been put down for driving the sewing machines. The *Bulletin International des Telephones* says that the working leaves nothing to be desired.

ELECTRIC LIGHT NEWS

—— The Citizens' Electric LightCompany of Akron, Ohio, have now nearly 200 lights running of the Thomson-Houston system.

—— The new company just started in Norwich are to put in a 100-light Thomson-Houston plant. The gentlemen engaged in the enterprise are good business men, and will make it a success.

—— The wards of the new female hospital, Berlin, are lighted by 96 incandescent lamps, only 72 of which, however, are in action at one time, the motive power being supplied by a 9-horse steam engine.

—— The New Haven Electric Light Company (Thomson-Houston) is paying a dividend of 16 per cent. General Manager Frost seems to be the right man in the right place, as he evidently knows how to run an electric light company.

—— The new plant just put in at Achison, Kansas, has been so successful and satisfactory, that the local company, in order to comply with the demand, have duplicated their order with the Thomson-Houston Electric Company.

—— It is said that Mr. Swan has estimated the life of an electric glow lamp at about 5,800 hours. This is a very high average, and the conditions under which it was attained, in the case of the Swan lamp at least, must have been exceptionally favorable.

—— It has been decided to light the Imperial Palace, the Court Opera House, and the Burg Theater of Vienna with electric light. The palace will be illuminated with 5,000 lights, the opera house with 4,000, and the Burg Theater with 3,000. The arrangements will be completed by next autumn.

——The stockholders of the Grand Rapids Electric Light and Power Company, of Grand Rapids, Mich, on Monday last elected the following directors: Messrs. J. W. Converse, W. T. Powers, W. H. Powers, A. B. Watson, James Blair, Henry Spring and E. S. Pierce. The directors elected officers as follows: President, W. T. Powers; Vice-President, James Blair; Secretary and Treasurer, W. H. Powers.

—— When the Hartford Electric Light Company first put in their plant of 100 lights, they little thought of the demand there would be for this system of lighting. They soon increased to 200, and now, to supply the increase, they have decided to put in another additional 100-light plant, making 300 lights in all. Their system is the Thomson-Houston, which, under the good management of President Dunham, is giving universal satisfaction.

—— On a recent feast day at Cotopaxi, Mexico, the leader of a band of thieves in that section concocted a scheme for a large haul of plunder by extinguishing the electric light in the cathedral. He used a small wire which, in his ignorance he threw over the exposed wires of the electric light, and the current passing through his body killed him instantly. His confederates were appalled at the sudden death of their leader and fled, escaping capture.

—— On Wednesday last, at Worcester, Mass., at the annual meeting of the electric light company, the following directors were chosen: Thomas M. Rogers, Stephen Salisbury, Loring Coes, Theodore C. Bates, W. A. Denholm, Samuel Winslow, Samuel E. Hildreth, Nat. S. Liscomb, Charles B. Whiting, Josiah Pickett, and A. B. R. Sprague. Herbert H. Fairbanks was chosen clerk and treasurer, in place of Mr. Whiting, who declined a re-election. There are already 200 lights in operation, and the meeting voted to increase the plant by fifty.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JANUARY 20, 1885.

310,776 Armature for dynamo-electric machines; C. F. Brush, Cleveland, Ohio.

310,879 Electrical cable; Henry A. Clark, Boston, Mass.

310,934 Suspension of aerial cables; Ezra T. Gilliland, Boston, Mass., assignor to the American Bell Telephone Company, same place.

310,957 Manufacture of compounds to be used for insulating; Alexander Muirhead, Norwood, County of Surrey, England.

310,961 Telephone; Harry P. Pratt, Chicago, Ill., assignor, by mesne assignments, to himself, Chas C. Bonney, John A. Hamlin, and Charles E. Barrett, all of same place, and William R. Plum, Lombard, Ill., trustees.

310,970 Shuttle-operating mechanism for looms; Edward S. Winchester, Boston, Mass.

311,072 Automatic cut-out for electric lamps; William Hochhausen, New York, N. Y.

311,073 Electric arc lamp; William Hochhausen, New York, N. Y.

311,074 Focusing electric arc lamp; William Hochhausen, New York, N. Y.

311,100 Socket for incandescent electric lamps; Sigmund Bergmann, New York, N. Y., assignor to Bergmann & Co., same place.

311,131 Combined gas and electric light fixture; P. H. Klein, Jr., New York, N. Y., assignor to Bergmann & Co., same place.

311,141 Regulator for dynamo-electric machines; Benjamin F. Orton, East Saginaw, Mich.

311,142 Voltaic arc lamp: William P. Hatton, Harrisburgh, Pa., assignor of one-half to W. E. Macklin, same place

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

An Electric Railway Test.

Mr. E. M. Bentley, of Cleveland, Ohio, of the Bentley-Knight Electric Railroad, in operation in that city, who is visiting here, says that the recent severe snow-storm in the West has tested the electric railroad system very thoroughly. It has been feared by some that a hard snow-storm would interrupt travel. As to that he says: "Last Friday the conditions could not have been more unfavorable. The snow was deep and wet, covering track and conduit to a depth of several inches, but the first car ran out over the road as if it were a dry day in midsummer, plowing its way through the snow without the slightest difficulty, and, though snow and sleet fell all day, there was no interruption or delay. Nor did we experience any loss of current by leakage, though in our system we employ a higher electromotive force than has been heretofore thought feasible. This is the first time an electric railway has been tested under severe conditions, and the result is very gratifying."

One of the most thorough and enterprising of our young manufacturers of electrical apparatus, is Mr. Hugo Kayser, whose factory is located at No. 12, Elm street, this city. His principal business is on experimental and model work for inventors, and contract work for electric light companies. We were shown among other things of interest in his shop recently some very finely finished telegraph instruments.

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